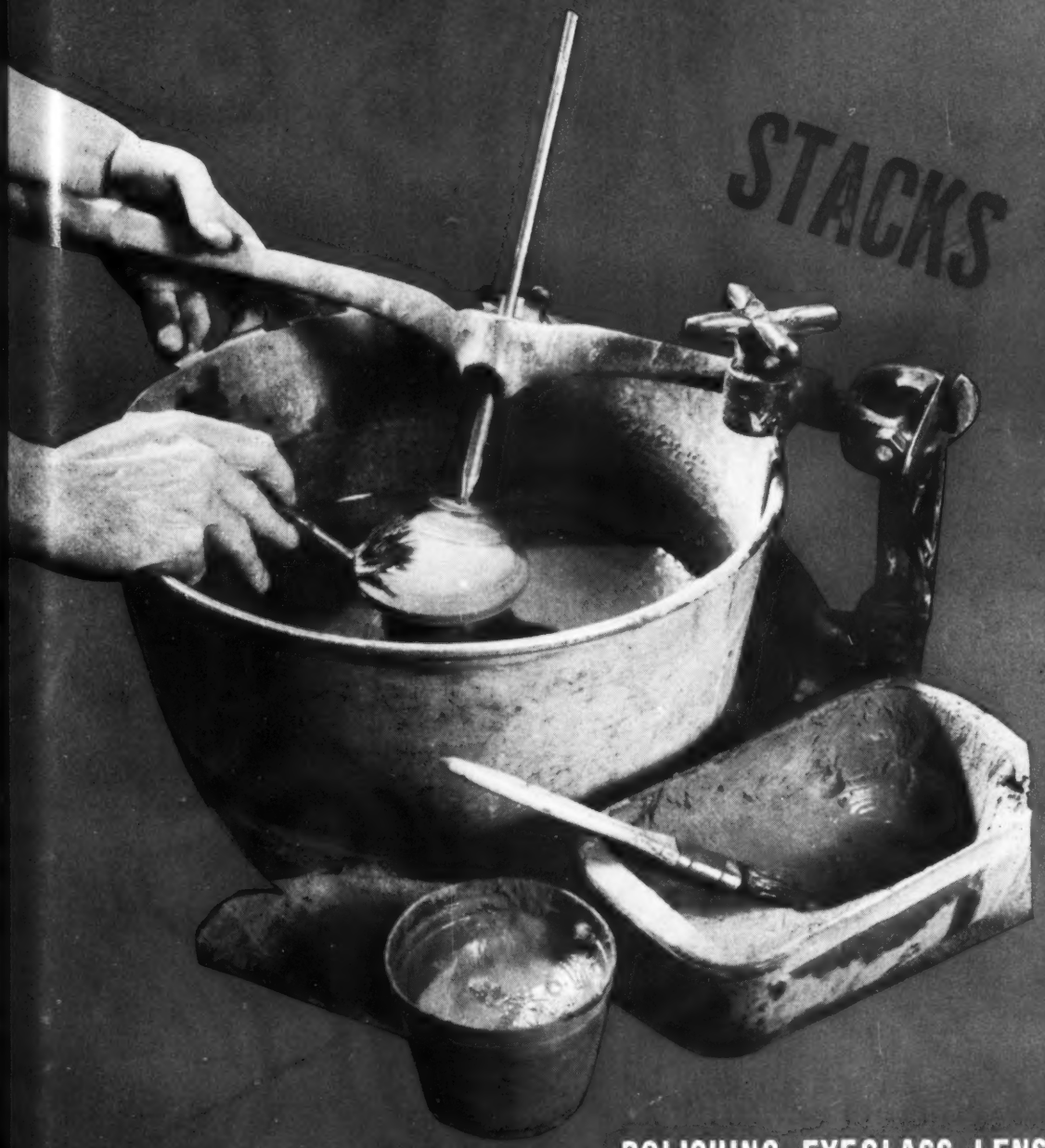
K666.1
SCIENCE & TECHNOLOGY
LOS ANGELES PUBLIC LIBRARY
DEC 26 1961

THE GLASS INDUSTRY

THE JOURNAL OF GLASS MANUFACTURING

DECEMBER 1961
SIXTY CENTS PER COPY

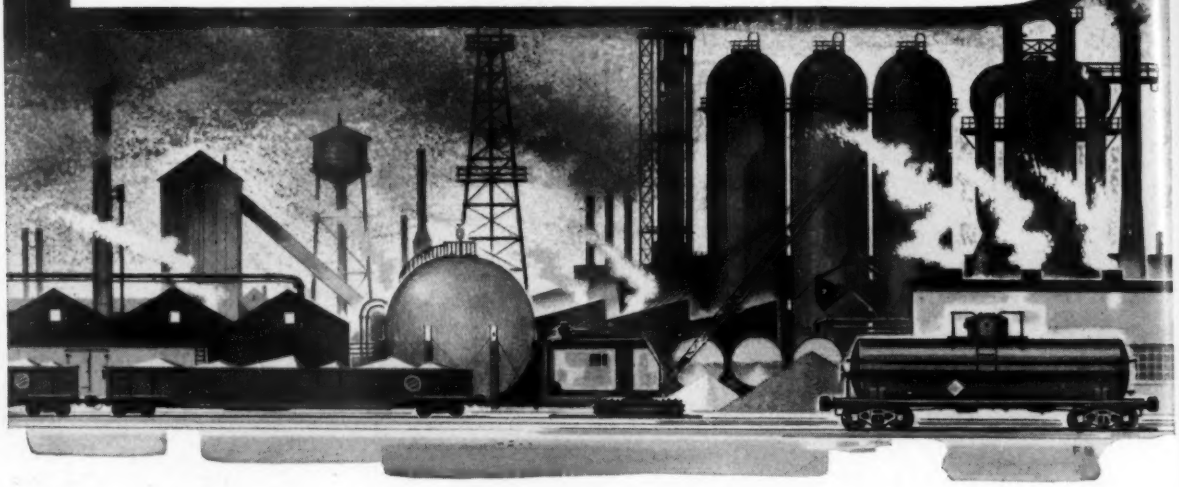


POLISHING EYEGLASS LENS BY HAND

Is Your Industry Listed Here?

HARSHAW Manufactures Products for these and other Industries

Abrasives • Aeronautical
Atomic Energy • Automotive
Brick and Tile • Ceramic
Cement and Concrete
Chemical • Cosmetic
Disinfectants
Electrical Manufacturing
Electronic
Electroplating • Enamel
Engraving and Electrotyping
Explosive • Fat and Oil
Feed Stuff, Mineral Feed
Fertilizer • Food
Foundry • Glass
Insecticide and Fungicide
Laundry • Leather
Lithographing
Linoleum and Floor Covering
Lubricant • Match
Metallurgical • Metal Working
Oil Cloth • Optical
Paint, Varnish and Lacquer
Paper • Petroleum
Pharmaceutical • Photographic
Porcelain Enamel • Plastics
Pottery • Printing Ink
Pyrotechnic • Refractories
Rubber • Soaps
Steel • Textile
Welding Electrodes • Wall Paper



TO BE SPECIFIC: HARSHAW PRODUCTS FOR THE CERAMIC INDUSTRY

- **BODY STAINS, GLAZE STAINS, UNDERGLAZE COLORS**—Used in sanitary ware, tile, dinnerware, artware, and colored brick.
- **HYDROFLUORIC ACID, AMMONIUM BIFLUORIDE**—For frosting, etching and polishing glass.
- **PORCELAIN ENAMEL OXIDES**—Used in appliances, signs, steel sanitary ware, light fixtures.
- **GLASS ENAMELS**—For decorating beverage bottles, tumblers, and for glass wall panels.
- **CADMIUM SULPHIDE ORANGE**—Used in manufacturing colored glass.
- **VARIOUS METALLIC SALTS AND OXIDES SUCH AS:**

Antimony Oxide • Cadmium Acetate • Cadmium Nitrate • Cadmium Oxide • Cadmium Sulfide
Cobalt Carbonate • Cobalt Nitrate • Cobalt Sulfate • Copper Oxide Black • Manganese Hydrate
Nickel Carbonate • Nickel Nitrate • Nickel Oxide • Tin Oxide • Zinc Acetate • Zirconium Oxide

IN ADDITION: More than 50 miscellaneous batch raw materials.

We will be happy to provide information on any of the material listed above.

THE HARSHAW CHEMICAL CO.

1945 EAST 97TH STREET • CLEVELAND 6, OHIO

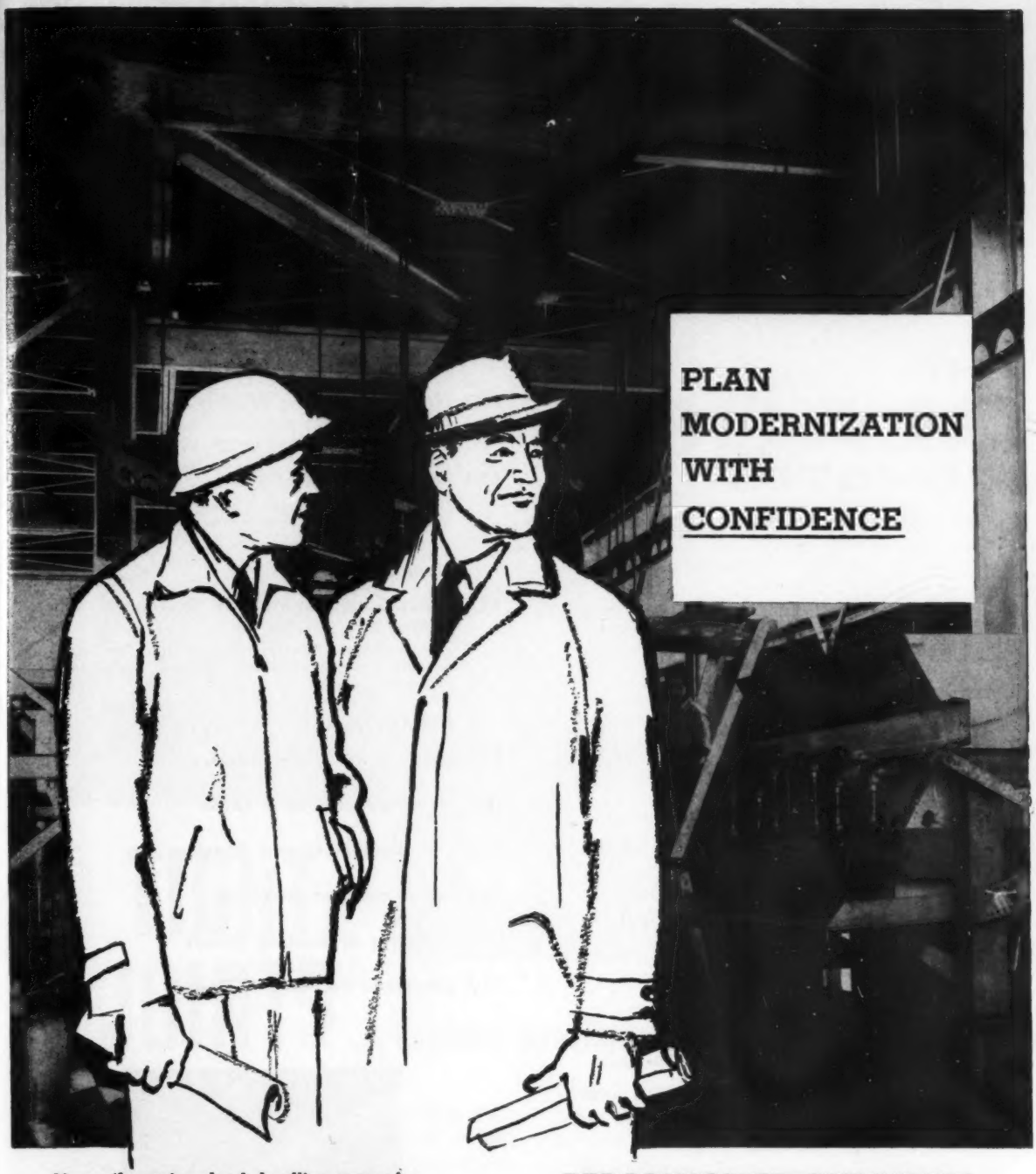
Chicago • Cincinnati • Cleveland • Detroit • Houston • Hastings-On-Hudson, N. Y. • Los Angeles • Philadelphia • Pittsburgh

FREE BOOKLET
"Harshaw Chemicals for Industry and Laboratory"

Write today for your copy

HARSHAW

Reader Service Card: Circle No. 1



Monorail-container batch handling system for prominent Latin-American Glass Manufacturer.

PERSONALIZED EXECUTIVE ENGINEERING . . .

. . . is traditional at Frazier-Simplex with all of the inherent advantages of top-level supervision and administration of your project from start to finish.

You can rely upon Simplex designed modernization programs to embrace *only* proven equipment and systems.

FRAZIER-SIMPLEX, inc.
Engineers
428 EAST BEAU ST.—WASHINGTON, PENNA., U. S. A.

TANK FURNACES • PRODUCER GAS PLANTS
BATCH HANDLING SYSTEMS • STACKERS
DECORATING AND ANNEALING LEHRS
BATCH CHARGERS • COMPLETE PLANTS

Pre-Engineered, Pre-Fabricated, Economical Metal Buildings 6113-3-57

Reader Service Card: Circle No. 4

Vol. 42, No. 12 December 1961

THE GLASS INDUSTRY

An Ogden Publication Devoted to Glass Technology, Engineering, Materials and Glass Factory Equipment and Operations

Published by
The Ogden Group of The Reuben H. Donnelley Corp.
466 Lexington Ave., New York 17, N. Y.

Publisher	VINCENT M. RABUFFO
Associate Publisher	KATHERINE WALLER OGDEN
Editor	FRANK S. CHILD
Managing Editor	PATRICIA L. CONWAY
Advertising Manager	JOSEPH H. McGROARTY, JR.
Production Manager	HELEN F. OGDEN
Circulation Manager	FRANK L. MACK

REPRESENTATIVE:

Chicago — Davis & Sons
30 North La Salle Street
Chicago 2, Ill.
Telephone: FRanklin 2-9052

THE GLASS INDUSTRY is published monthly by Magazine Publishing Division, The Reuben H. Donnelley Corporation. Subscription $5.00 a year. Canada and foreign $7.00. Single copies 60 cents domestic; 70 cents Canada and foreign. Issues over three months old 70 cents; over one year, $1.50; over five years, $2.00. Second class mail privileges authorized at New York, N. Y. Curtiss E. Frank, Chairman of the Board; Hamilton B. Mitchell, President; Edward A. O'Rorke, Vice-President; Fred C. Ash, Secretary-Treasurer and General Counsel; Karl G. Clement, Controller; John Mileham, Division Controller.

Copyright, 1961, The Ogden Group, Reuben H. Donnelley Corp.

ARTICLES

681 6th International Congress on Glass.
Fifty papers are scheduled for delivery at the first Congress to be held in this country.

683 Grinding and Polishing Lenses for Eyeglasses.
Great strides have been made since World War II in the development of optical abrasives and polishing compounds.

686 Glass Division Meeting.
The first of a two-part series reviewing papers presented at Bedford Springs in October.

693 New Glassblowing Machine.
Kimble Glass Co.'s $15 million paste mold machine has recently been put into scientific glassware production.

694 Feldspar by Flotation.
How a New England plant mines pegmatite and extracts from it feldspar, sand, mica, and iron.

Fiber Glass

697 Epoxy-Glass Laminations. By John M. Jewell, Conap, Inc.
The marriage of epoxies and fiber glass has resulted in a tough, corrosion-resistant material useful in many industries.

DEPARTMENTS

700 News in the Glass Industry

704 New Applications in Glass

705 New Equipment and Supplies

706 Inventions and Inventors

709 Calendar of Coming Events

710 Statistical Position of Glass

Some eyeglasses must be hand generated because they are too flat for machine grinding. Here, the operator is using a fine emery paste made from aluminum oxide. This is the final step before polishing. *See story, page 683.*

TIGHT JOINTS ...Corhart precision-grinds all throat joints!

Diamond-Ground ZAC® Throats Stop Glass Penetration. New diamond-ground surfaces of ZAC blocks result in extremely tight, uniform joints. These joints give your throats positive protection against glass penetration and corrosion. A new diamond-grinding process, combined with rigid Corhart specifications, now assures you of longer throat life.

A feeler gauge test is one of the final quality checks on each ZAC block. Many checks on visual quality, density, hardness, and dimensional accuracy precede this... and others follow. These thorough Corhart product-value tests are part of a broad Corhart program to help you economically achieve ever higher glass quality.

Watch for new improvements in refractory performance first from Corhart. For more information on Corhart Refractories write: Corhart Refractories Company, Incorporated, 940 Commonwealth Building, Louisville 2, Kentucky.

The words "Corhart", "ZAC", and "Electrocast" are registered trade marks which indicate manufacture by Corhart Refractories Company, Incorporated.

CORHART | REFRACTORIES COMPANY

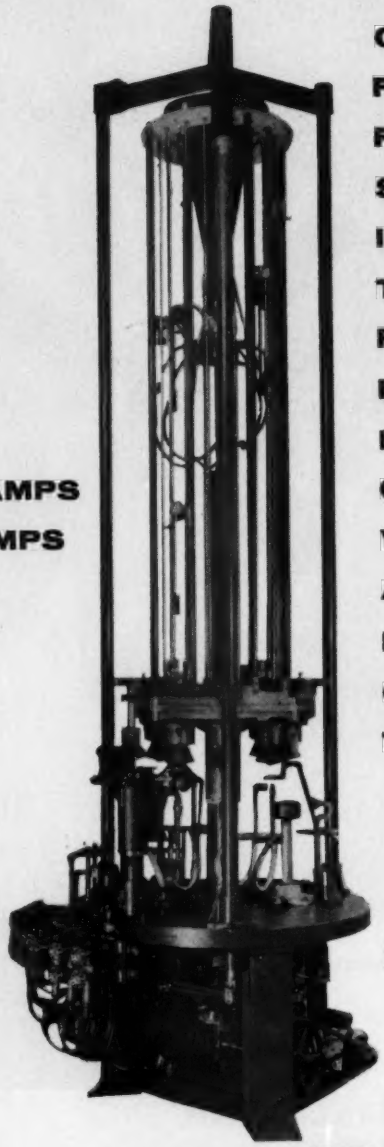
Subsidiary of Corning Glass Works

FIRST IN REFRACTORY RESEARCH/DEVELOPMENT

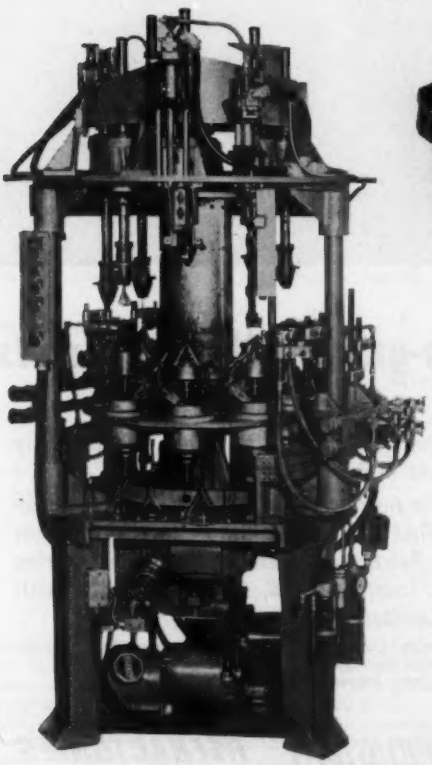
Reader Service Card: Circle No. 5

AMPULES
BULBS
BOTTLES
SYRINGES
TEST TUBES
VACUUM BOTTLES
GOBLETS
STEM WARE
BEADS
INCANDESCENT LAMPS
FLUORESCENT LAMPS
ELECTRON TUBES
DIODES
RESISTORS
SWITCHES

CUTTING
FORMING
FLARING
SPLICING
INSERTING
TUBULATING
PUNCHING
H. F. SEALING
H. V. ARC SEALING
GAS HEAT SEALING
VACUUM SEALING
ANNEALING
ETCHING
CLEANING
TESTING



MACHINE NUMBER 1523
Automatic ampule/bulb blowing machine.



MACHINE NUMBER 3451
For splicing tubular spouts to funnels or bulbs.

KÄHLE

ENGINEERING COMPANY

3330 HUDSON AVENUE
UNION CITY, NEW JERSEY

DESIGNERS AND BUILDERS
OF PRODUCTION MACHINERY

AUTOMATIC EQUIPMENT & METHODS
FOR MANUFACTURING GLASS PRODUCTS
LAMPS, ELECTRONIC COMPONENTS ETC.

through Technology...Materials...Research...

TRONA® BORON CHEMICALS MAKE YOUR GOOD PRODUCTS BETTER

TRONA boron chemicals are vital to the ultimate quality of the products you manufacture ...and TRONA boron technology, through advanced research and development, is creating new and versatile forms of boron for your products of the future. Knowledge of boron chemicals and their production in volume are special capabilities of American Potash & Chemical Corporation, a basic and expanding source of boron for industry and agriculture.
BORAX sodium tetraborate • V-BOR refined pentahydrate borax • TRONABOR agricultural pentahydrate borax • PYRO BOR anhydrous borax • BORIC ACID orthoboric or boracic acid • SODIUM PENTABORATE • ELEMENTAL BORON • BORIC ACID ANHYDROUS boric oxide • *plus these current developmental products:* Titanium Diboride • Rare Earth Boredes • Boron Halides • Boron Carbon Compounds • Boron Phosphorous Compounds

TRONA **American Potash & Chemical Corporation**

3000 West Sixth Street, Los Angeles 54, California
99 Park Avenue, New York 16, New York

SALES OFFICES: LOS ANGELES, NEW YORK, CHICAGO, SAN FRANCISCO, PORTLAND (ORE.), ATLANTA, COLUMBUS (O.), SHREVEPORT

Producers also of: SODA ASH • POTASH • LITHIUM • BROMINE • CHLORATES AND PERCHLORATES • MANGANESE DIOXIDE • ELECTROLYTIC MANGANESE METAL • THORIUM • RARE EARTH AND YTTRIUM CHEMICALS

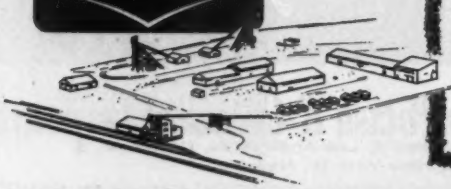
the new Wyoming source of

SODA ASH

with Stauffer nationwide service facilities!

The completion of Stauffer's new Wyoming plant to supplement existing West End facilities will expand the market for Stauffer soda ash into areas served traditionally by Stauffer nationwide offices in supplying industrial chemicals. The large traffic department experienced in nationwide distribution problems can effect efficiency and economy in the transport of bulk or bagged soda ash from Stauffer's two natural sources. Let us suggest practical ways you can be supplied economically at your point of consumption. Simply address the coupon below and mail. We invite consultation with our glass technologist and furnace engineer and use of our laboratory services.

Stauffer CHEMICALS



WE ARE INTERESTED IN KNOWING THE BENEFITS TO US OF STAUFFER AS A SODA ASH SUPPLIER.

YOUR NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

Please mail to West End Chemical Co., 636 California Street, San Francisco, Calif.

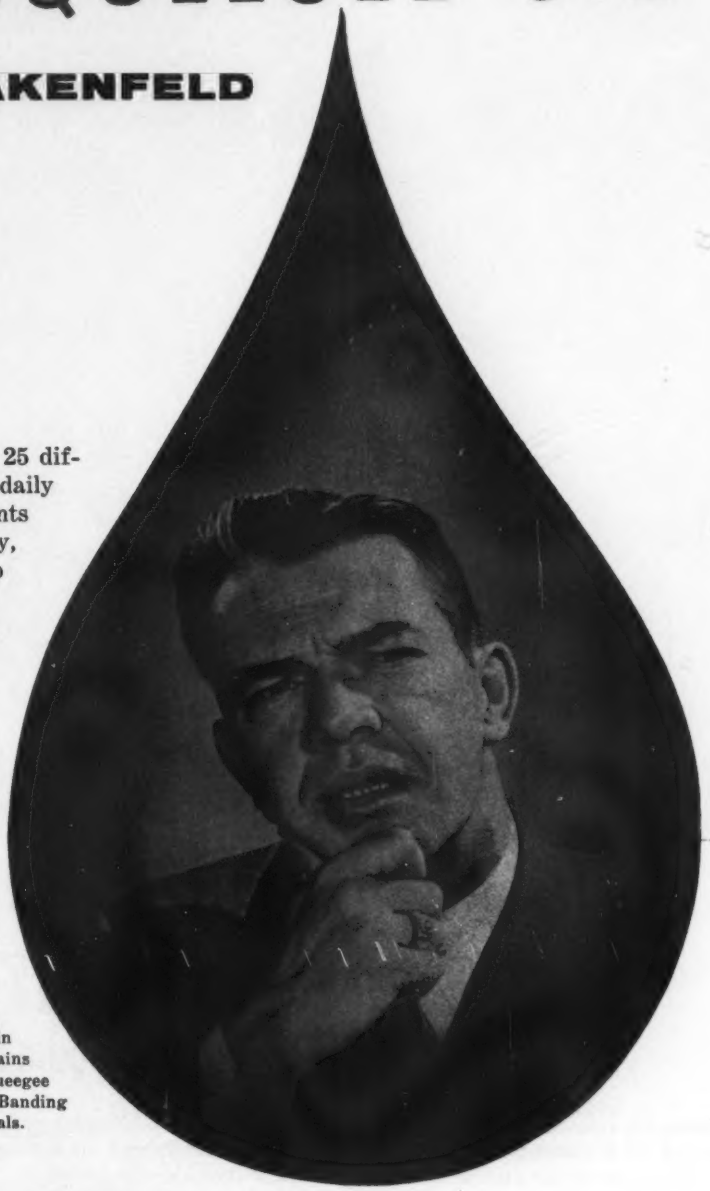
WEST END CHEMICAL COMPANY • DIVISION OF STAUFFER CHEMICAL COMPANY

SAN FRANCISCO, 636 CALIFORNIA STREET • CHICAGO, PRUDENTIAL PLAZA • ST. LOUIS 19, P. O. BOX 48

If Your Decorating Problem Is

SQUEEGEE OIL

TURN TO DRAKENFELD



Drakenfeld produces more than 25 different squeegee oils that are used daily in glass decorating departments throughout the world. In this way, Drakenfeld Squeegee Oils help solve specific problems that go along with the differences in firing techniques and temperatures used in decorating an infinite variety of glass articles. And, Drakenfeld research is constantly at work creating new oil compositions to meet other individual problems.

We welcome the opportunity to supply samples of our regular squeegee oils and to develop new ones. Phone or write.

DEPENDABLE SERVICE ON: Acid, Alkali and Sulphide Resistant Glass Colors and Enamels . . . Crystal Ices . . . Porcelain Enamel Colors . . . Body, Slip and Glaze Stains ...Overglaze and Underglaze Colors...Squeegee and Printing Oils . . . Spraying and Banding Mediums . . . Metallic Oxides and Chemicals.

CALL ON **Drakenfeld**

UR PARTNER IN SOLVING COLOR PROBLEMS

B. F. DRAKENFELD & CO., INC.

Executive Offices: 45 Park Place, New York 7, N. Y.

Factory and Research Center: Washington, Pa.

06-5

Pacific Coast Agents:

BRAUN CHEMICAL COMPANY, 1363 So. Bonnie Beach Place, LOS ANGELES 54, California, Phone: ANgelus 9-9311

BRAUN-KNECHT-HEIMANN COMPANY, 1400 Sixteenth Street, SAN FRANCISCO 19, California, Phone: HEmlock 1-8800

CHEMICAL DETECTIVE

solves crimes

AGAINST GLASS QUALITY

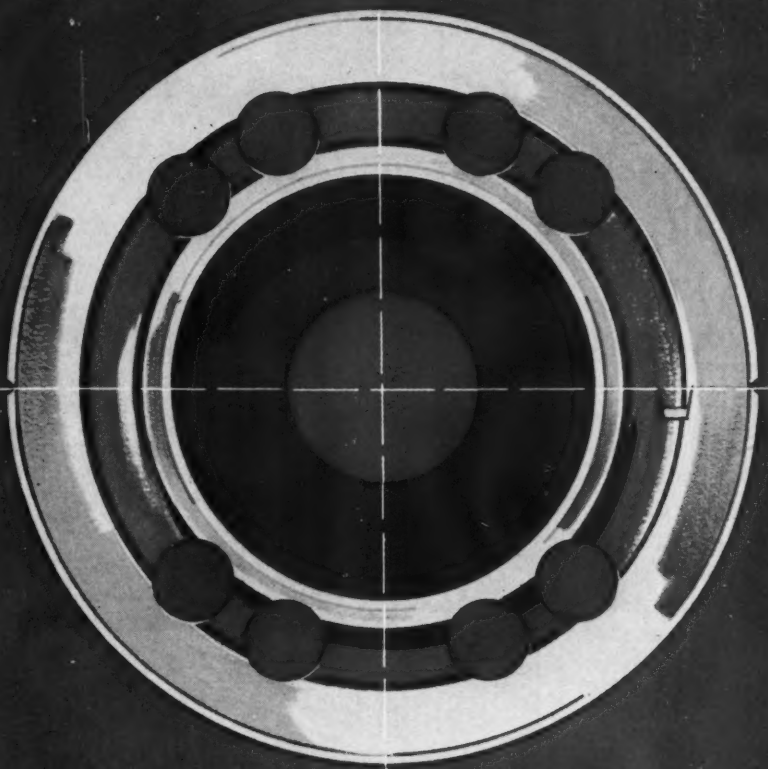
Adjusting his microscope, the petrographer at the Barberton laboratory of PPG Chemicals is hot on the trail of a culprit. "Stones" in glass — unfused particles — reduce the durability and spoil the appearance of glass containers. By identifying the exact composition of the stones, PPG Chemicals glass technicians help glass manufacturers track down the source of the problem so they can correct it. In addition to the microscope, they make use of X-ray diffraction, spectrography, microchemical analysis, and other tests to complete their detective work.

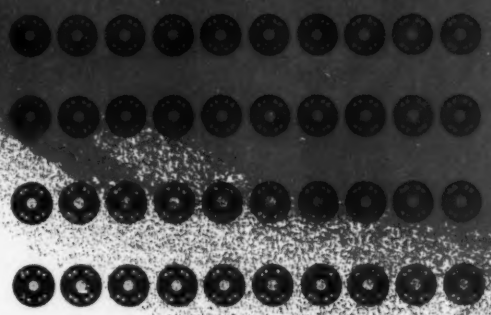
PPG Chemicals has a long-standing interest in the quality of glass containers, because we have been a major supplier of soda ash and other chemicals to glass producers for many years. Our laboratories also include complete units to duplicate plant conditions of pulp and paper making, textile processing, and other processes. Practical applied research which helps our customers produce better products is another extra value built into PPG Chemicals. Are we on your list of approved suppliers? Pittsburgh Plate Glass Company, Chemical Division, One Gateway Center, Pittsburgh 22, Pa. In Canada: Standard Chemical Limited.

PPG chemicals

precision neck rings

MASS PRODUCED





No part of a mould is more critical than a neck ring, and to produce it in large volume calls for unusual skill plus highly specialized equipment. Overmyer's leadership in developing such equipment now makes it possible to turn out over 3,000 precision neck rings per week. The result: Production economies that make it more practical to replace a neck ring than to repair it.

OMCO **OVERMYER MOULD COMPANY, INC.**

GENERAL OFFICES: WINCHESTER, INDIANA

FACTORIES IN WINCHESTER, INDIANA • FREMONT, INDIANA • GREENSBURG, PENNSYLVANIA • SOUTH GATE, CALIFORNIA.

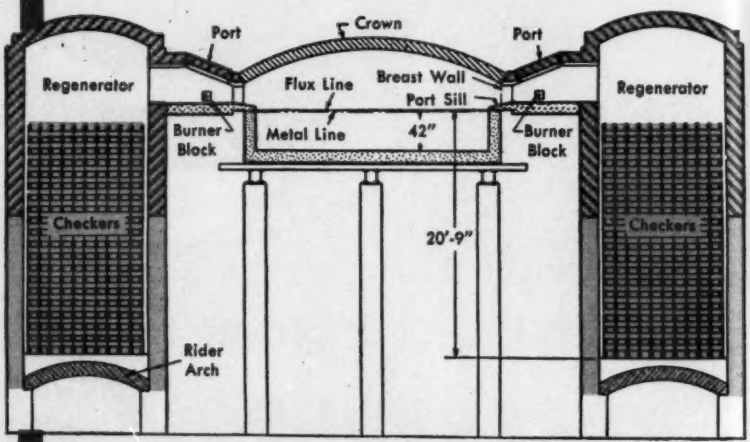
There is no such thing as a "typical" glass tank, and...

Naturally, the type of glass you manufacture and the particular characteristics of your operations determine your choice of refractories for ports, regenerators, checkers, arches, and other vital locations.

The arrangement of B&W Refractories shown is not "typical." It does show where glass manufacturers have profitably used B&W specialized refractories in their tanks. In your case, too, B&W specialized refractories can meet exacting requirements.

To help you achieve longer campaigns with minimum maintenance, we suggest you contact your local B&W Refractories representative or write to The Babcock & Wilcox Co., Refractories Division, 161 East 42nd Street, New York 17, New York.

B&W Firebrick are used extensively in vital sections of glass tanks such as walls and arches of ports and regenerators; upper and lower courses of checkers; and rider arches. B&W Firebrick widely used in glass tank service include B&W 80, B&W 80-Dense, B&W Juniors and B&W Kao-HB.



Shaded areas show where B&W Firebrick were used in one container glass tank.

B&W

THE BABCOCK & WILCOX COMPANY

REFRACTORIES DIVISION

B&W Firebrick, Insulating Firebrick, and Refractory Castables, Plastics, Ramming Mixes, Mortars, and Ceramic Fiber.

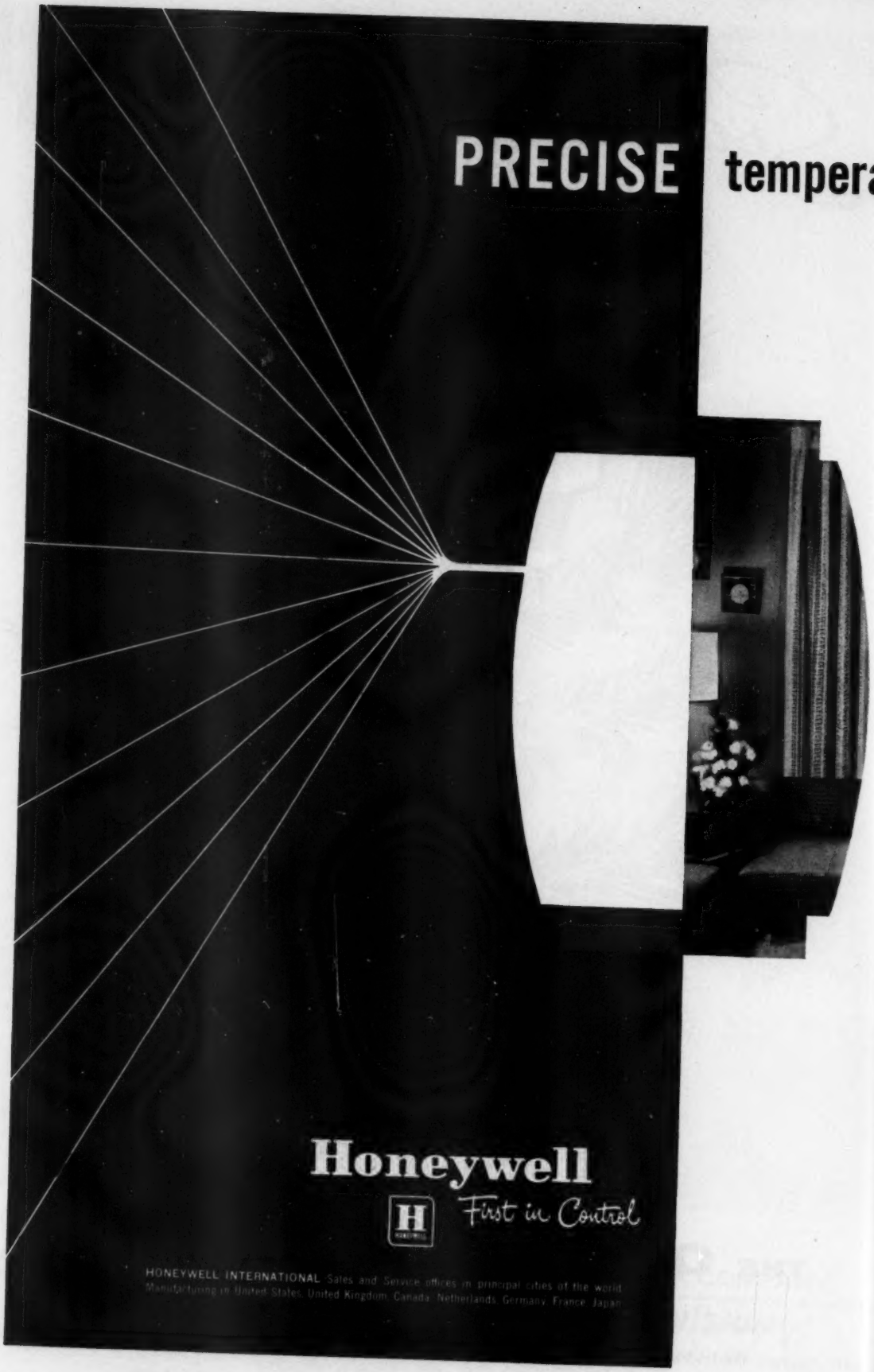
Season's Greetings
Our sincerest wishes for a HAPPY YULTIDE season ... laden with love, warm friendship and good fellowship.
May the spirit of peace on earth to men of good will prevail during the coming YEAR
... and may health and prosperity be yours.

THE O. HOMMEL CO.

PITTSBURGH 30, PA.

West Coast — 4747 E. 49th Street, Los Angeles, California

HOMMEL


PRECISE
Honeywell
First in Control
HONEYWELL INTERNATIONAL Sales and Service offices in principal cities of the world.
Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan

atu control – key to Fiberglas* quality

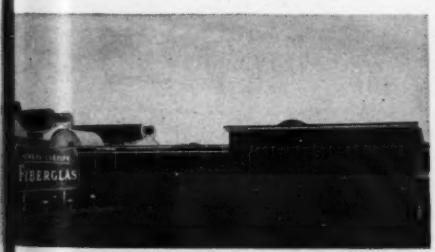
The manufacture of Fiberglas—one of the truly versatile glass materials of our time—calls for precise temperature control at critical points in the process. To get this control, production engineers at the new Owens-Corning Fiberglas Corporation plant in Aiken, South Carolina, rely on Honeywell *ElectroniK* Scanning Systems and Precision Temperature Controllers.

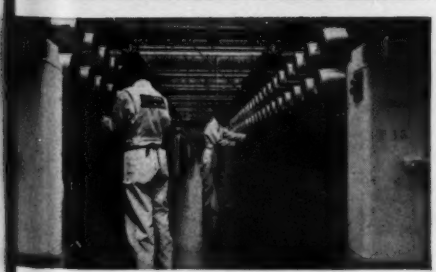
To ensure close control of the initial glass making portion of the process, two *ElectroniK 15* scanners continuously monitor more than 375 points in the glass tank and the forehearth. Any point not at the set temperature is printed out on an *ElectroniK* recorder to provide a record of the off-normal temperature. Scanners are also equipped to give visual and audible alarms.

The molten glass flows from the furnace into small, individual "bushings" (box-shaped chambers) and out through tiny discharge nozzles to form continuous filaments. Temperature control at this point is extremely critical. Even a slight deviation in bushing temperature produces variations in length and thickness of the filament.

To get the close control necessary to maintain filament uniformity, Owens-Corning uses a Honeywell Precision Temperature Controller, an Electr-O-Volt three-mode controller, and a Honeywell magnetic amplifier for each bushing. These precision controllers hold bushing temperatures to within ¼ degree at operating temperatures exceeding 2,000°F!

This Fiberglas control installation typifies the precision and dependability you can expect from Honeywell Temperature Control Systems. If you require this kind of precision control for your glass manufacturing operation, be sure to get in touch with your local Honeywell field engineer. He'll analyze your control requirements and make detailed recommendations. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.





The new Owens-Corning Fiberglas plant at Aiken, South Carolina, the nation's most modern synthetic fiber plant, produces annually well in excess of 10 million pounds of yarns and rovings for use in decorative and industrial products.

After the Fiberglas fibers are dried, they are twisted and wound on bobbins. Fibers are coated with a special sizing material to make them easier to work with in later processing.

Two Honeywell ElectroniK Scanning Systems continuously monitor the critical areas of the glass tank and forehearth. The third scanning system keeps a constant check on the temperature of the bushings through which the molten glass flows to form filaments.

*Trademark Reg. U.S. Pat. Off.

fmc® SODA ASH

FLOWS "FREE & EASY"

for faster handling

You save time unloading FMC Soda Ash and in getting it from bins or silos into operations.

The reason is simple. FMC Soda Ash is composed of roller-shaped crystals that don't lump up, stick or bridge over. Besides flowing freely, these crystals don't degrade into fines. They make FMC Soda Ash virtually dust-free.

Other features of FMC Soda Ash: Consistently high purity, fast dissolution, low iron and no ammonia content. And you get fast, reliable shipment in our own covered hopper cars.

You can enjoy the advantages of premium-quality FMC Soda Ash and it will cost you no more. Why not ask for our quote?

fmc® CORPORATION

CHLOR-ALKALI DIVISION

161 E. 42nd Street, New York 17

THE
GLASS
INDUSTRY
THE JOURNAL OF GLASS MANUFACTURING
VOLUME 42 NUMBER 12 DECEMBER, 1961

6th International Congress on Glass

For the first time the United States will be host country to the Congress when it meets July 8 to 14, 1962, at the Sheraton Park Hotel, Washington, D. C.

Four fields of glass technology will set the theme for the Sixth International Congress on Glass next year. The program is under the direction of Dr. Guy E. Rindone, Pennsylvania State University, and Dr. John H. Koenig, Rutgers University, will preside. Fifty papers from 15 different countries are now scheduled.

The four major program divisions, *(1)* process principles in continuous glass melting, *(2)* structure of glass, *(3)* metal-glass interaction during conditioning and forming, and *(4)* properties of new glasses for unusual applications, will be followed by brief announcements of recent discoveries in glass research and technology. At that time, last-minute developments of interest to those attending the Congress will be discussed.

Sessions on the form, design, art, archeology, and history of glass will feature *(1)* technical foundations for the connoisseur, *(2)* design trends and development, and *(3)* American debts and contributions to European art glass and tableware of the early Nineteenth Century. Papers on all topics will be presented by internationally recognized authorities, and deliveries in German, French, or English will be translated simultaneously into the other two languages.

DEADLINES

A complete set of all papers scheduled will be presented in one volume to each registrant at the time of the meeting. In order to have his paper appear in that volume, the author must submit his completed manuscript to Dr. Rindone no later than January 31, 1962. Contributions to the discussion of recent discoveries will be accepted as late as June 15, 1962.

DETAILS ON MEETING

For further information on the Sixth International Congress on Glass, contact *Charles S. Pearce, General Secretary, American Ceramic Society, 4055 North High St., Columbus 14, O.* Throughout the coming months, THE GLASS INDUSTRY will keep its readers up to date on plans for the meeting.

PAPERS SCHEDULED TO DATE

I. Process Principles in Continuous Glass Melting

BELGIUM

Physico-Chemical Study of Glass Melting under Vacuum. By G. Letocarte, M. Pierre, M. Boffee, and E. Plumat, Glaverbel, Charleroi.

A Study of the Diffusion of Na at the Perphery of Quartz Crystals. By MM. Leger and Bray and E. Plumat, Glaverbel, Charleroi.

ENGLAND

The Volatilization of Constituents from Borosilicate Glass at Elevated Temperatures. By L. F. Oldfield, Research Lab., General Electric Co., Ltd., Wembley.

JAPAN

Mixing of Glass in Tank Furnaces by Model Techniques. By M. Kunugi and K. Takahashi.

Formation and Growth of Bubbles in the Process of Glass Melting. By T. Izumidani and R. Terai.

POLAND

Corrosion Phenomena Observed during Melting of Some Selected Glasses—Their Physico-

Chemical Interpretation and Economical Evaluation. By J. Jablkowski and J. Chmielenski.

SWITZERLAND

Melting Window Glass Electrically. By E. Borel.

UNITED STATES

Improved Techniques for Studying the Design and Operation of Glass Melting Furnaces by Means of Models. A film by the staff of Owens-Illinois Glass Co. Text by J. C. Hamilton, R. R. Rough and W. B. Silverman, Owens-Illinois Glass Co., Toledo, O.

Dissolution Kinetics in Glass Melting. By A. R. Cooper, Jr., Massachusetts Institute of Technology, Cambridge, Mass.

The Kinetics and Mechanisms of Subliquidus Alkali Carbonate-Silica Reactions. By R. V. Harrington, J. R. Hutchins III, and J. D. Sherman, Corning Glass Works, Corning, N.Y.

Transport Phenomena, Homogenization, Refractory Solution, and Gas Evolution in Continuous Glass Melting. By H. H. Blau, Ohio State University, Columbus, O.

II. Structure of Glass

BELGIUM

Some Particular Aspects of Flow and Relaxation Processes in the Transformation Range. By P. Gilard and J. de Bast, Institut National du Verre, Charleroi.

CZECHOSLOVAKIA

Contribution to the Problem of Structure of Glass from the Point of View of Transition from Silicate Melt into Glassy State. By M. Fanderlik.

EGYPT

Gamma Ray Induced Coloring of Glasses in Relation to Their Structure. By A. Bishay.

ENGLAND

Diffusion of "Water" in Silica Glass. By T. Drury, G. J. Roberts, and J. P. Roberts, The Houldsworth School of Applied Science, The University of Leeds.

The Resistance of Glasses of Simple Composition to Attack by Sodium Vapor. By C. A. Elyard and H. Rawson, Research Laboratory, AEI Ltd., Rugby, Warwickshire.

FRANCE

Some Aspects of Rayleigh Scattering in Glass and its Relation to the Structure. By A. Winter.

Modifications of Elastic Properties of some Glasses Irradiated with Neutron. By MM. Paymal and Le Clerc.

Experimental Proof for the Flow of Glass in the Mechanical Polishing Process. By N. Navez and I. Peyches.

Suitability of Various Glass Structures to Chemical Dealkalization. By MM. Asolo and de LaJarte.

GERMANY

Measurement of the Physical and Chemical Solubility of Gases in Glass Melts (He and H_2O, Respectively). By H. Scholze, H. O. Mulfinger, and H. Franz, MPI, Wurzburg.

Exchange of Ion and Diffusion Processes in Glass. By A. Sendt, Gerresheimer Glashutte, Dusseldorf-Gerresh.

Elastic and Plastic Stress Birefringence of Glasses in the Annealing Range. By W. K. Geffcken and A. Jacobsen, Jenaer Glaswerk, Mainz.

INDIA

Origin of Red Color in Copper Ruby Glass. By A. Ram and S. N. Prasad.

JAPAN

Glass Formation Range and Glass Structure. By M. Imaoka.

NETHERLANDS

Some Aspects of the Mechanical Behavior of Glass. By A. M. Kruithof, Philips, Eindhoven.

UNITED STATES

Magnetic Resonance and Spectroscopy in the Study of Electronic and Structural Properties of Glasses. By R. F. Tucker, Corning Glass Works, Corning, N.Y.

A Study of the Source and Distribution of Griffith Cracks on Glass Surfaces. By F. M. Ernsberger, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

RUSSIA

Two papers. Titles and authors tentative.

III. Metal-Glass Interaction during Conditioning and Forming

BELGIUM

A Kinetic Study of Contact Phenomena between Soda-Lime Silicates and Different Minerals, Boride, and Nitride Materials. By MM. Boffee and Van Tournhoudt and E. Plumat, Glaverbel, Charleroi.

ENGLAND

Alkali Mobility at Glass Surfaces During Forming and Annealing and Its Effect on the Chemical Properties of the Surface. By S. M. Budd and J. J. Kirwan, United Glass Ltd., Charlton, London.

GERMANY

Measurement and Calculations on the Time-Temperature Relationship at the Interface Metal-Glass Melts. By M. Coenen, MPI, Wurzburg.

ITALY

Fluoborate Alkaline Glasses and Their Interactions with Metals during Braising. By V. Gottardi and B. Locardi, Stazione Sperimentale del Vetro, Murano-Venecia.

NETHERLANDS

Use of Analogs for the Study of Heat Flow in Glass Shaping Processes. By M. H. de Lange, Philips, Eindhoven.

UNITED STATES

A Study of Flow Forming Delivery Systems. By Container Engineering Dept., Owens-Illinois Glass Co., Toledo, O.

Effect of Composition on the Glass-Iron Interface. By F. Gaudos and J. Pask, University of California.

Analysis of Heat Transfer in Glass Pressing Operations. By T. J. Naughton and D. A. McGraw, Owens-Illinois Glass Co., Toledo, O.

IV. Properties of New Glasses for Unusual Applications

CZECHOSLOVAKIA

The Melting and Crystallization of Basic Rocks. By J. Voldan.

ENGLAND

Applications of Glass Scintillators in the Detection of Neutrons and Other Types of Nuclear Radiation. By D. G. Anderson, British Scientific Instrument Research Association, South Hill, Chislehurst, Kent.

The Preparation and Properties of Silicate Glasses of Unusual Compositions. By P. W. McMillan, the English Electric Co. Ltd., Nelson Research Laboratories, Stafford.

GERMANY

Dielectric and Optical Properties of Glasses in the System Arsenic—Sulfur—Halogen. By E. Deeg, Jenaer Glaswerk, Mainz.

ITALY

Ratio Ce^{+++} Ce^{++++} in the Melting of Different Glasses, and Influence on their Properties. By V. Gottardi, G. Paoletti, and M. Tornati.

JAPAN

Effect of Temperatures during U. V. Exposure in a Photosensitive Glass. By R. Yokota.

Binary Phosphate, Borophosphate and Aluminophosphate Glasses, Their Properties and Structure. By K. Takahashi.

NETHERLANDS

Physical and Chemical Properties of New Glasses. By H. J. L. Trap and J. M. Stevels, Philips, Eindhoven.

NORWAY

Crystallization Studies of $Na_2O—Al_2O_3—SiO_2$ Base Glasses. By S. Urnes, Silicates Institute, Trondheim.

UNITED STATES

Chemical, Physical, and Electrical Properties of Some New Inorganic Glasses. By A. D. Pearson, W. Northover, and J. Dewald, Bell Telephone Lab., Murray Hill, N. J.

Ultrahigh Strength Glasses by Ion Exchange and Surface Crystallization. By S. D. Stookey, J. S. Olcott, H. M. Garfinkel, and D. L. Rothermel, Corning Glass Works, Corning, N.Y.

RUSSIA

One paper. Title and author tentative.

Five grades of abrasives and polishing compounds used in grinding and polishing lenses.

Grinding and Polishing Lenses for Eyeglasses

McLeod Optical Co., Inc., was established in 1922 and is generally recognized as the largest independent laboratory in the East. Through its main facilities in Providence, R. I., (25 technicians) and two branches in Springfield and Northampton, Mass., the company services the three eye-care professions—optometrists, ophthalmologists, and opticians.

McLeod stocks about 10,000 different foci and types of lens blanks and, to fill a prescription, uses either rough or semifinished blanks, depending on the prescription. The semifinished are completed on the outer, or bifocal, side only. Both types are purchased from such producers as Bausch & Lomb, Inc., Shuron Optical Co., American Optical Co., and Continental Optical Co., with sizes ranging from 54 mm. to 58 mm., in the standard form, up to 73 mm. for special lenses, like sun glasses.

Grinding

In the finished process, the blank is lined up on a protractor, in accordance with the axis shown in the prescription, and markings are made to indicate the thickness of the finished lens—the lens blanks are originally 3 to 12 mm. thick; the final lens is ½ to 1½ mm. thick, depending on the power, or size, required. Before the lens blanks can be ground, they must be blocked with clear pitch to a curved brass lens body. This serves as a base, or holder, for keeping the lens blank in position.

Small chunks of pitch are melted in electrically heated pots (Fig. 1); at the same time, the lens blanks and brass bodies are preheated so as to achieve a perfect bond of uniform thickness. The pitch is applied to the brass body as illustrated, and the blank is placed on top. No pressure is required, since the weight of the blank causes the pitch to spread out evenly, and the

Fig. 1. Blocking the lens blank to brass body with clear pitch.

Fig. 2. Automatic generating. Blanks are in semicircular box.

Fig. 3. Hand generating, and applying #125 abrasive with brush.

bond is complete.

While green or black pitch was used for many years in this operation, before the development of automatic generating (grinding) equipment, clear pitch is preferred today because the operator can see through it in order to line up the guide markings on both the blank and block, making sure of a perfect placement.

In machine generating (Fig. 2) an oil coolant (Shell Palla) is applied over the lens and wheel; the only abrasive necessary is an aluminum oxide fine emery #125 Micro-Graded Optical Powder* of 12.5-micron size. Because of its crystal shape, this oxide removes glass with a rolling, rather than digging, action, which produces a smoother surface for the final finishing and polishing operation.

*K. C. Abrasive Co.

Lenses with less than a three-base curve must be hand-ground because they are too flat to be generated by machine. In this case, McLeod begins with the rough, or #60 grade, roughing emery, manufactured from silicon carbide. Extremely hard and sharp, and very friable, the silicon carbide cuts fast and, in breaking up—always fracturing with very sharp edges—resharpens itself.

The #60 is followed with #180 grade, or "second emery," made from aluminum oxide. This is slower cutting than silicon carbide but does not gouge or leave the scratches that can be expected from silicon carbide.

The third step in hand generating uses #302, also an aluminum oxide, while #125 aluminum oxide is the final abrasive, as in automatic generating. However, in hand generating, the #125 is made into a paste by

Fig. 4. Truing of cast iron lap, for polishing inside surface of glass.

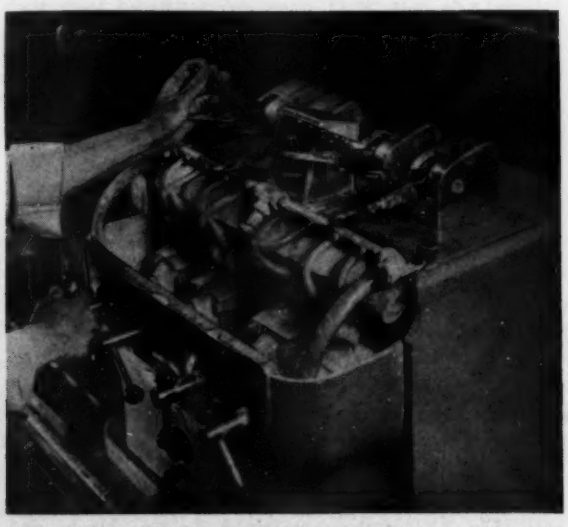


Fig. 5. Final polishing in Coburn machine, using cerium oxide.

mixing the abrasive with water and is applied with a brush (Fig. 3) by the operator.

Polishing

Final polishing is done both manually and by machine, with an optical quality cerium oxide† in each case. For hand polishing, the cerium oxide must be in thin paste form; in automatic polishing, a solution of ¼ lb. oxide to 1 qt. water is recirculated through the machine and performs effectively for a week, without change.

Cast iron laps (Fig. 4), shaped into the curve of the lens, do the polishing. For working on the inside of the lens, they are shaped as illustrated; for the convex surface, concave laps are used. McLeod estimates it has more than 5000 different laps for cylinder lenses, and 400 others for spherical lenses, ranging from plano (no power) to ±16 diopters in 1/12-diopter steps, and from there to ±20 diopters in ¼-diopter steps. A nonwoven composition pad is attached to the laps when finishing cylinder lenses in automatic machines; for spheres, thin felt pads are used. Some of the machines polish four lenses at a time (Fig. 5), others, two at a time. They run 8 hours a day, and each polishing operation takes 18 minutes.

The lenses must be removed from the brass bodies at this point. This is done by freezing the brass bodies to −18°F in a calcium chloride solution. Separation is performed in seconds, in contrast to the former time-consuming method of chipping the pitch away by hand —which frequently resulted in breakage.

Cleaning

The lenses are cleaned with a small ultrasonics unit†† to remove any clinging pitch or polishing compound.

†Davison Chemical Co.
††Branson Instruments, Inc.

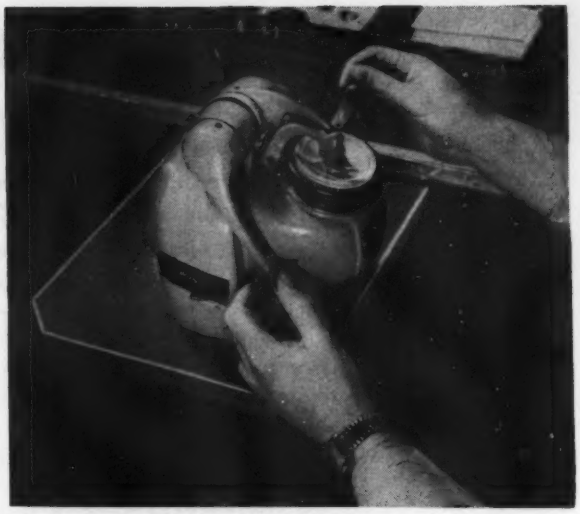


Fig. 6. Rough cutting finished lens, 2 mm. over final size.

Estimated cleaning time per lens is 10 seconds, much quicker than past procedures which required scrubbing, rubbing and soaking in solvents. No scratches are possible with ultrasonics, and, according to McLeod, various forms of solvent-caused dermatitis suffered by workers have been completely eliminated. The solution which is used gives off no fumes, and it is changed once a week.

Cutting and Edging

After cleaning, the lenses are lined up by a vertometer which orients the axis and marks it with a series of dots in stamp pad green ink. The lens is cut roughly to shape, 2 mm. over the finished size (Fig. 6) by a machine using carboloy cutting wheels. The most common final lens sizes are 40 mm., 42 mm., and 46 mm. The lens then goes to an automatic edger (Fig. 7) equipped

(*Continued on page* 711)

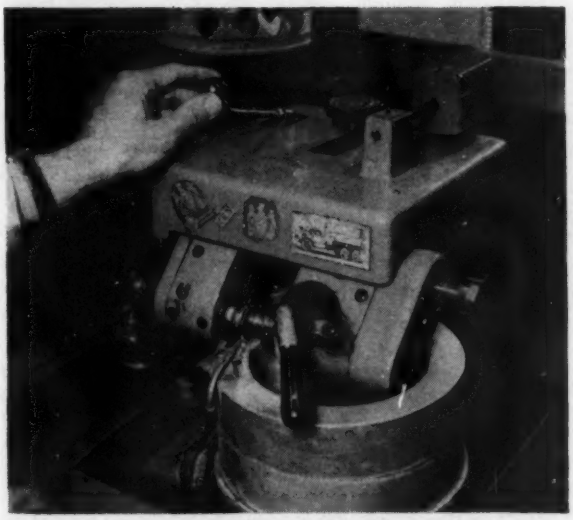


Fig. 7. Automatic edger with carbide wheel.

Fig. 8. Final inspection of eye glasses with vertometer.

Glass Division Meeting

A technical review of papers delivered at Bedford Springs, October 11 to 13. The program was organized by a committee of three: H. E. Simpson, Alfred University (chairman), C. L. McKinnis, Owens-Corning Fiberglas Corp., and J. L. Rood, Bausch & Lomb, Inc.

THURSDAY MORNING

Method of Measuring Electrical Conductivity vs. Temperature for Refractories for All-Electrical Glass Furnaces.

By Larry Penberthy and Howard Harris, Penberthy Electromelt Co., Seattle, Wash. Presented by Penberthy.

Work with electric melting of glass has revealed that electrical conductivity of refractories is related to the rate of corrosion. Potential gradients between electrodes often are in the range of 0.5 volt per centimeter, with the total power input in some cases exceeding 2000 kw. Small power arcs between the refractory blocks and the supporting steel have occasionally been observed.

During the investigation of the electrical conductivity of various refractories, the information from various manufacturers seemed to be inconsistent, leading to the question of whether the methods of taking measurements were valid enough to allow comparison of the various data. Inconsistencies in the readings on single samples were also noticed, which might have been due to the unreliability of making electrical contact with the ends of the refractory sample bars. In working with the problem, a circuit which appears to avoid this major difficulty was developed.

The accuracy of this method depends largely on the accuracy of the meters and equipment used in the measurements. Essential features of the method are that the voltage-measuring circuit does not draw an appreciable current, so that contact resistance at certain points does not influence the readings. The current drawn by the amplifier of the oscilloscope is several orders of magnitude smaller than the current passing between the various contacts, and can be ignored.

As a substitute for an oscilloscope, a regular voltmeter having an internal resistance of 15,000 ohms (5,000 ohms per volt) was tried, but there was an appreciable error in the readings at the lower temperatures, because the volt-meter itself was drawing about 0.05 milliamperes. This error can be ignored for many purposes when the measured resistance is less than 1000 ohms.

It was believed, however, than an ac potentiometer would be better than a voltmeter. An ac potentiometer is similar to the dc potentiometer used in measuring the output of thermocouples, except that it has a phase-shift adjustment and provides a bucking voltage from an ac source rather than a dc source. The drawback is that such an instrument costs as much as an oscilloscope. Several readings were tried using direct current, but it was found that polarization caused a swift decrease in the current flow. Probably the decrease in current due to polarization would have stabilized, and valid readings could have been taken, but dc testing was not considered within the scope of this paper.

A method of measuring conductivity was presented which avoids the errors arising in the uncertain resistance of the terminals. Two electrical leads were used on the ends of the sample for carrying the current and two intermediate spaced leads were used for measuring the voltage drop. Conductivity was graphed as amperes per volt across a 1-cm cube. Graphs for several fusion-cast refractories were given for the range 1800° to 2800°F.

X-Ray Absorption Fine Structure of Glasses.

By W. F. Nelson, I. Siegel, and R. Wagner, Fundamental Research Section, General Research Div., Owens-Illinois Technical Center, Toledo, O. Presented by Nelson.

When considering such things as electronic behavior or structure-dependent phenomena in solids (including glass), one is faced with the problem of finding ways to make measurements which yield information about events and mechanisms on a microscopic or atomic scale. In other words, although a great deal can be learned from the many macroscopic measurements available, there comes a time when the results must be relatable to behavior and mechanisms involving the individual entities making up the solid.

As an illustration of the point, consider the many diffraction techniques which have been used to investigate the structure of solids. Thus, we have X-ray diffraction, electron diffraction, neutron diffraction, etc. However, all of these methods suffer from the same limitations.

1. They are essentially cooperative phenomena in the sense that they become more and more difficult to interpret as the number of participating particles is reduced, *i.e.*, as the size of the region in which the phenomena take place becomes smaller. Thus, in the X-ray diffraction case, as the particle size of a crystalline sample is reduced, its diffraction pattern becomes less and less "crystalline" and more ambiguously like an "amorphous" or liquid diffraction pattern.

2. It should also not be forgotten that the interpretation of diffraction measurements has been greatly dependent for success upon the rather restrictive stipulation of crystalline order and symmetry which has made much of the mathematics of the theories involved tractable. On an anthropomorphic basis, this might be one more example of the limitations of "togetherness" and the need for a certain amount of atomic independence.

With the development of such tools as nuclear magnetic resonance and electron spin resonance (paramagnetic resonance), techniques have become available in which the phenomena involve only highly localized regions (few entities) such as specific nuclei, specific atoms, or, at the most, specific atomic groups. In effect, one has available a sensitive probe, capable of investigating very limited regions in the solid. When examined with a spectrometer of sufficiently high resolution, the behavior of the X-ray absorption coefficient in the vicinity of an absorption edge is found to depend upon the physical or chemical environment of the element whose absorption edge is being measured. Although X-ray absorption spectroscopy is a well-known tool, it has not been extensively applied to elements when in the glassy state.

This paper reported measurements made on the Fe and Ge K-absorption edges when the iron was in a sodium silicate glass and the germanium was in the amorphous form of GeO_2, as well as in the two crystalline modifications of GeO_2. From the results obtained, the following observations were made.

1. X-ray absorption phenomena can give useful information about the amorphous or glassy state, as well as the crystalline state, of solids. Such information is readily obtainable in many laboratories since it requires only a conventional X-ray diffraction unit and some patience.
2. Such measurements made on glasses would be of particular value to the field of solid state physics since the data obtained would help clarify the theoretical picture of X-ray absorption in solids.
3. There is frequently a shift of the main absorption edge of an element when observed in different compounds. The possibility exists of utilizing this shift as a nondestructive means of measuring valence states in a solid.
4. The results of measurements made on the GeO_2 system in the amorphous state indicate that the glass has a degree of order and symmetry very similar to, or identical with, the hexagonal crystalline modification of GeO_2. The notion of a true random network does not seem to be applicable to the GeO_2 glass.

Controlled Potential Coulometry of Lead, Cadmium, and Zinc in Glasses.

By P. R. Segatto, Research and Development Div., Corning Glass Works, Corning, N.Y.

A controlled-potential coulometric determination of lead, cadmium, and zinc was reported. Lead and cadmium are quantitatively reduced at potentials of –0.48 volt and –0.67 volt vs. S.C.E., respectively. When arsenic and antimony are present, the lead and cadmium can be quantitatively oxidized at –0.20 volt and –0.40 volt vs. S.C.E., respectively. Arsenic and antimony are rendered electrochemically inactive during the oxidation and do not interfere. Zinc is determined by reduction and quantitative oxidation at –0.500 volt vs. S.C.E. rom an ammonia-citrate medium. Data were presented which indicate that the three ions can be determined down to about 0.2 millifaradays with a precision of ±0.3 per cent in approximately 30 minutes.

Controlled-potential coulometry also allows for the clean-cut separations of undesirable constituents prior to subsequent analysis. Lead and zinc may be determined prior to the gravimetric determination of alumina. Large quantities of lead and cadmium may be separated and determined prior to the determination of small amounts of calcium by flame photometry. Also, lead may be determined and separated prior to the polarographic determination of small amounts of cobalt and nickel. In general, when applicable, controlled-potential separations are rapid and clean, and avoid the problem of coprecipitation often encountered in separatory precipitation methods.

FRIDAY MORNING

A Simplified Thermal Expansion Apparatus.

By E. H. Fontana, Research and Development Div., Corning Glass Works, Corning, N.Y.

The construction and operation of a simplified dilatometer was described, which is capable of measuring thermal expansion coefficients of solid materials accurately to within ±2 per cent or ±1 by 10^{-7}/°C, whichever is greater, in less than an hour.

The unit consists of cage-like structure formed by cementing three 9-in. diameter plates to three ¾-in. diameter fused silica rods 18 in. long, positioned 120° apart. A pedestal, sample, and push rod are positioned vertically along the central axis by holes drilled at the centers of the plates. The push rod makes contact with a dial gage mounted to the top plate. Heating is accomplished by placing an 8½-in. long coil of Nichrome wire encased between two pieces of Vycor brand tubing around the sample.

Calibration is begun by probing with a thermocouple to find the amount of current necessary to maintain a desired temperature level. Measurements are then made on materials having known expansion coefficients, and the apparatus constant is calculated. The instrument is inexpensive to build, compact, and easy to operate. This makes it ideal for quality control work and research projects which are scanning wide fields.

Properties of Alumino-Borate Glasses of Group II Metal Oxides: Part II, Electrical Properties.

By Chikara Hirayama, Westinghouse Materials Lab., Pittsburgh, Pa.

It is well known that the substitution of B_2O_3 for SiO_2 in silicate glasses results in decreased electrical conductivity. The conductivity of borate glasses is, in general, lower than that of the silicates. Some evidence of the stronger bond between the metal ion and network oxygen in borates, as compared to silicates, has recently been shown by Hirayama. Owen, at Sheffield University, has shown the excellent electrical insulating properties of the calcium alumino-borate glasses and has found exceptionally high activation energies for conduction.

The homogeneous glass-forming region of the alumino-borate glasses of Group II metal oxides and some of their physical properties were reported in an earlier paper of the author. It was shown that the electronic configuration of the metal ion determines the properties of the glass to an appreciable degree. The present paper reported the electrical properties of these glasses.

The glasses were prepared from reagent grades of boric acid, aluminum oxide, Group II-A carbonates, and oxides of zinc and cadmium. The samples were prepared by fusion of the premixed ingredients, contained in a platinum crucible, at 1200°C to 1450°C in an electric furnace. The melt was heated for at least 1 hour at these temperatures before being poured into an iron ring of 5-cm diameter. The disks, as cast, were at least 5 mm thick. The samples were annealed at a temperature 50°C below the sag point, and slowly cooled. The sag point corresponds to a viscosity of approximately 10^{10} poises. The disks were subsequently ground to a thickness of 3 mm, with faces parallel to within ±0.025 mm.

A portion of the quenched glass of each sample was analyzed. Silver paint electrodes were applied to both faces of the disks for electrical measurements by the two terminal method. The samples were placed in a heavily lagged temperature-controlled furnace (±3°C) and allowed to heat at 100°C for several hours before the first measurements were made. The resistivity was measured on an electrometer with 500 volts applied from a battery supply. The dielectric constant and dissipation factor were measured on a General Radio 716-AS-1 capacitance bridge at each temperature at frequencies of 0.060, 1, 10, and 100 kc per sec. The electrical properties of the glasses were measured at seven temperatures between 100°C and 500°C. With most of the samples resistivity could not be measured reliably at temperatures below 200°C because of the high values beyond the sensitivity of the electrometer (10^{15}-ohm maximum sensitivity).

The data obtained showed that the activation energy for resistivity decreases with increasing concentration of Group II metal oxide, and is nearly independent of the Al_2O_3 content. In the case of BaO-Al_2O^3-B_2O^3 glass, the activation energy is 42 kcal at 10 mole per cent BaO, and 30 kcal at 60 mole per cent BaO. The log resistivity of these glasses at 450°C varies from 11.5 to 7.3 respectively. Glasses in the MgO series have the lowest activation energy (~33 kcal), but the highest resistivity (~10^{11} ohm/cm) at 450°C. These activation energies are all considerably higher than those found in sodium-containing glasses.

An Electrochemical Method for Determination of the Ferric-to-Ferrous Ratio in Iron-Containing Soda Lime Glasses.

By Morton B. Blinn, Glass Research Center, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

There are several methods available to the experimenter who wishes to determine the ratio of iron (III) to iron (II) in a glass. An example is the orthophenanthroline colorimetric method in which the glass is first dissolved in hydrofluoric acid, ferrous ion determined as the colored ferrous-orthophenanthroline complex, and ferric ion determined from the difference between total iron, as the ferrous-orthophenanthroline complex, and ferrous ion. This method suffers the disadvantage of being inaccurate when the concentration of either ion is much less than the other, because the determination of ferric involves the difference between total iron and ferrous iron. Other such difference methods can be inaccurate for the same reason. A polarographic method, which involves determining each ion separately, was studied and found to be no more accurate than the orthophenanthroline method.

The purpose of this study was to develop a new method for determining the ferric-to-ferrous ratio in plate-type glasses which would be reliable when the concentration of either ferric iron or ferrous iron, or both, is low. The Nernst equation points the way to a satisfactory solution of determining the ferric-to-ferrous ratio.

All measurements were made at 25.00°C ±0.05°C in a water bath. Temperature control was accomplished using a modified thermocap relay attached to a Bureau of Standards calibrated thermometer, calibrated to 0.1°C. Chemicals were reagent grade, and used without further purification. The electrodes used in the early stages of the studies were a Beckman fiber type saturated calomel electrode and a platinum indicating electrode consisting of various shapes of platinum foil or screen welded to a short length of platinum wire which in turn was sealed into a glass tube. When it was decided that a long salt bridge which was capable of being flushed to remove contaminants was necessary, three different types of calomel electrode vessels were used, one of commercial design (Wilson Modification, calomel electrode vessel, Fisher Catalogue No. 11-506-40), and the other two basically the same.

The methods of preparing the electrodes were somewhat different. Electrode A was prepared by triturating mercurous chloride with mercury and saturated potassium chloride solution. This was added to a depth of 1 cm to the cell which contained mercury; then potassium chloride solution saturated at 90°C was added to

the vessel and a layer of KCl formed as the solution cooled to room temperature. Electrode B was prepared by violently shaking a mixture of calomel and mercury for 20 minutes using a Wig-L-Bug, an instrument used by dentists in preparing silver amalgams.

The resulting black powder was washed three times with saturated potassium chloride solution and added to the vessel to a depth of 0.5 cm over mercury, after which coarse KCl crystals were added and then saturated with KCl solution. Electrode C was prepared by manually shaking a mixture of calomel and mercury for 10 minutes to give a gray powder which was added to a depth of 1 to 2 mm over a mercury pool; coarse KCl crystals were then added, followed by saturated KCl solution. The interior of electrode vessel C was coated with Beckman Desicote, rinsed with acetone, air-dried, and baked at 185°C for 72 hours prior to preparation of the electrode. These three electrodes, different in vessel design and also in the manner in which chemically prepared, gave reference potentials which were very similar. Cell A gave a potential which was 0.0005 volts higher than cell B; cell C was 0.0002 volts lower than cell B.

All of the glasses used in these studies were plate glass compositions which contained iron. The composition of the base glass was 71.68 per cent SiO_2, 13.13 per cent Na_2O, 11.68 per cent CaO, and 2.38 per cent MgO. The glass used as standard had a total added iron concentration of 0.50 per cent as Fe_2O_3; all of the samples of this glass came from a single sheet. Analysis using the orthophenanthroline method showed that the molar ferric-to-ferrous ratio was 2.98. Samples of this glass were remelted under both oxidizing and reducing conditions. The oxidizing conditions consisted in remelting a 30-gram batch in air at 1265°C in a globar furnace for 65 hours using a Morganite crucible. The reducing conditions consisted in remelting a 30-gram batch at 1265°C for 65 hours; the graphite crucible, fitted with a graphite cover, was buried in graphite powder which was contained in a clay crucible with a close-fitting clay cover.

The procedure for determining the ferric-to-ferrous ratio in iron-containing plate glasses is as follows. Under nitrogen, react about 5 to 10 grams of glass with about 70 ml of 2.00 M HF to 2.00 M H_2SO_4 at least overnight. Centrifuge the resulting solution. Dip the end of a freshly prepared salt bridge consisting of 4 grams agar +41.40 grams NH_4Cl/100.0g H_2O into a portion of the centrifuged solution for 2 hours; attach the salt bridge to a saturated calomel electrode and dip the other end into another portion of the centrifuged solution along with a platinum electrode. While bubbling nitrogen through the solution, which is kept at 25.0°C, measure the potential difference between the electrodes, taking readings for at least a ½ hour to be certain that the

Forrest and Meyer Awards

Frank Forrest Award. Received by S. S. Flaschen, A. D. Pearson, and W. R. Northover for their paper, "Formation and Properties of Low-Melting Glasses in the Ternary Systems As-Tl-S, As-Tl-S, and As-Se-S," published in the *Journal of the American Ceramic Society*, May, 1960.

Dr. Flaschen, now research manager at the Motorola semiconductor products division, Phoenix, Ariz., was associated with Bell Telephone Lab., Inc., Murray Hill, N.J., from 1952 to 1960. During this time, research was conducted on low-melting glasses. Degrees received: B.S., University of Illinois, 1947; M.A., Miami University of Ohio, 1948; Ph.D. in geochemistry, Pennsylvania State University, 1953. He is affiliated with the electronics division of the ACS.

Dr. Pearson has been associated with the metallurgical research department at Bell Telephone Lab. since 1957. Degrees received: B.S., University of Durham, England, 1953; Ph.D. in organic chemistry, Massachusetts Institute of Technology, 1957. Affiliated with ACS electronics division; currently serving as secretary, Metropolitan New York section.

Nothover joined the metallurgical research department of Bell Telephone Lab. in 1957, after working as analytical chemist. Degrees received: B.A. in chemistry, New York University, 1952.

S. B. Meyer, Jr. Award. Received by B. S. R. Sastry and F. A. Hummel for their paper, "Studies in Lithium Oxide Systems: VII, Li_2O-B_2O_3-SiO_2," published in the *Journal of the American Ceramic Society*, January, 1960.

Dr. Sastry held a fellowship, sponsored by the Lithium Corp. of America, at the time research on lithium oxide systems was conducted in the College of Mineral Industries at Pennsylvania State University. Degrees received: B.S. in physics, University of Madras, India, 1943; B.S. Technical degree in ceramic technology, University of Madras, 1946; M.S. in ceramic engineering, University of Washington, Seattle, 1955; Ph.D. in ceramic technology, Pennsylvania State University, 1958. For 6 years before coming to the United States, he worked as research assistant and scientific officer in ceramics at the Regional Research Lab., Hyderabad, India, to which he has now returned as senior scientific officer.

Hummel, professor of ceramic technology, College of Mineral Industries has been on the Penn State faculty since 1946. Industrial experience: Onondaga Pottery Co., Syracuse, N.Y., and Corning Glass Works, Charleroi, Pa., and Corning, N.Y. Degrees: B.S. in ceramic chemistry, University of Illinois; M.S. in ceramics, Pennsylvania State University. A Fellow of the ACS, he is affiliated with the basic science division and has done graduate work in physical chemistry at Cornell University.

From the nation's leading supp

Solvay Chemicals for Glassmaking

Ammonium Bicarbonate

Potassium Carbonate

Soda Ash

Mutual® Bichromates

pp of glassmaking chemicals

SOLVAY SODA ASH

for purity...for uniformity...for quality in glassware

Solvay® Soda Ash and glass were made for each other! For it fits hand-in-glove with the properties of each ingredient essential to outstanding glassmaking. And you can count on steady supply and swift delivery from the nation's leading producer of glassmaking chemicals.

You can also depend on glass specialists in Solvay Technical Service to provide expert counsel on methods, batch formulations and material selection. May we apply our 75 years of glass industry background to your problems?

Allied Chemical

BASIC TO AMERICA'S PROGRESS

SOLVAY PROCESS DIVISION

61 Broadway, New York 6, N. Y.

Branch Sales Offices: Boston • Charlotte • Chicago • Cincinnati • Cleveland • Detroit • Houston
New Orleans • New York • Philadelphia • Pittsburgh • St. Louis • San Francisco • Syracuse

values obtained are constant. Calculate the ferric-to-ferrous ratio of the glass using expression

$$E = Em + \triangle Ej + Ecal = E^{\circ 1} + 0.05915 \log \frac{(Fe^{3}+)}{(Fe^{2}+)}$$

where Em=the measured potential, $\triangle Ej$=the junction potential correction, and $Ecal$=the saturated calomel electrode potential. Putting in values,

$$Em - 0.0075 + 0.2485 = 0.6787 + 0.05915 \log (Fe^{3}+)/(Fe^{2}+)$$

$$Em - 0.4404 = 0.05915 \log (Fe^{3}+)/(Fe^{2}+)$$

If the precision of the measured potential is ±0.0001 volt or less, the uncertainty in the calculated ferric-to-ferrous ratio will be less than ±3 per cent.

Results using the method described to determine the ferric-to-ferrous ratio in a plate glass containing 0.5 per cent iron as Fe^2O^3 are in good agreement with those obtained by the orthophenanthroline colorimetric method. This leads to the conclusion that the method of obtaining the value of the formal potential used in the calculations is at least approximately valid. It is estimated that when the ferric-to-ferrous ratio is near unity and the total iron concentration is high, *e.g.* around 0.5 per cent, the two methods are of equal value. However, when the total iron concentration in the glass is low, or when the ratio is such that either ferric or ferrous is low, this electrochemical method probably gives more accurate results because the potential which is measured is a direct function of the ratio, while the results obtained using the orthophenanthroline method depend upon a difference between two values.

Report by the National Academy of Sciences, National Research Council—Advisory Panel to the National Bureau of Standards, Mineral Products Div.

J. R. Hensler, Bausch & Lomb, Inc., Presided. Comments by Karl Schwartzwalder, former president, American Ceramic Society, N. J. Kreidl, Bausch & Lomb, Inc., and A. D. Franklin, National Bureau of Standards.

The advisory panel system started in 1948 with a discussion between two members of the society, Dr. Herbert Insley, then chief of the Mineral Products Div. of NBS, and Dr. John Whittemore, then president-elect of the ACS. When Dr. Whittemore became president of the society, he appointed the first advisory committee from ACS members who had been recommended to him by the section chiefs of the Mineral Products Div., NBS. The president and secretary of the society were ex officio members, and the director of NBS approved the arrangement. The committee met annually and spent 2 days reviewing the program of the Mineral Products Div. and made recommendations based on their knowledge of industry and bureau operations.

In 1952 the Kelley Committee (Dr. M. J. Kelley, then president of Bell Telephone Lab., Inc.), composed of leading scientists and engineers, recommended that all divisions of the bureau have technical advisory committees. The members of the committees were appointed by the bureau upon recommendation of the president of the ACS.

After 5 years of operation on the basis of the Kelley recommendations, the National Academy of Sciences — National Research Council took over, and the advisory panels are now under their jurisdiction. Members are recommended for the Mineral Products Div. panel, but the recommendations are not tantamount to nomination by NAB-NRC. The members of the panel are not all members of the ACS, but represent various technical societies. The purpose of the panels is to provide guidance for the director of the bureau and his staff in the formulation and execution of the NBS programs, and to provide the link by which the scientists and engineers of the country can be kept aware of the bureau's work.

Reports of the advisory panels have appeared in the *Bulletin of the American Ceramic Society* in 1955, 1956, 1957, and 1958. The following quotation from an early report of the panel indicates the desirability of fundamental research.

"There is need for greater emphasis on fundamental research [because] so much of the transferred work is in the nature of development work. It is believed that there should be a return to a sound program of fundamental research as the principal function of the Division."

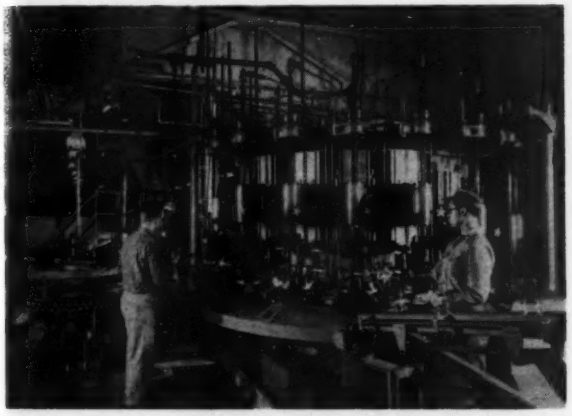
Present members of the committee include: Professor Pierce Selwood, chairman, Dr. Orson L. Anderson, Professor C. Ernest Birchenall, Dr. Joseph E. Burke, Dr. James R. Johnson, Dr. Norbert J. Kreidl, Professor J. W. Mitchell, Dr. E. F. Osborn, Mr. Karl Schwartzwalder, and Dr. Robert B. Sosman.

Primarily, the Bureau exists to ensure that this country has an adequate system of physical measurement, that this system is properly integrated within itself, appropriately calibrated, and tied in with systems of other nations. The division is organized in eight sections: *(1)* the vitreous state group under Dr. Alden Bestol, attached to the division office and reporting directly to Dr. Franklin, *(2)* the engineering ceramics section under M. D. Burdick, *(3)* the glass section under Clarence Hahner, *(4)* the refractories section (of which Sam Zerfoss was chief but which is represented only by the high-temperature reactions group), under R. F. Walker, *(5)* enameled metals under W. N. Harrison, *(6)* the new crystal growth section under Fred Orway, *(7)* another new section, physical properties, which does not yet have a chief, and *(8)* the constitution and microstructure section under H. F. McMurdie.

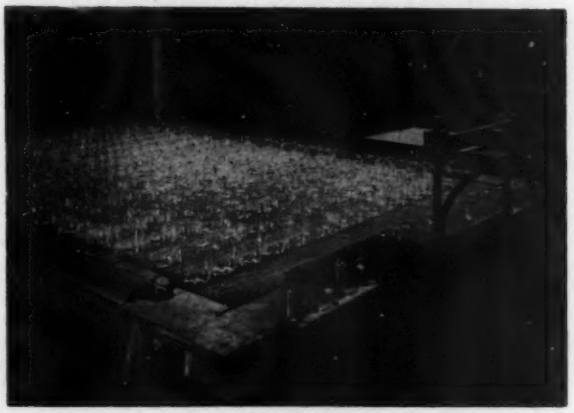
Division activities are also arranged on the basis of subject matter. Fundamental are those activities on preparation and characterization of research materials. Currently this includes not only the bureau's routine

(*Continued on page* 711)

NEW GLASSBLOWING MACHINE



According to the U.S. Department of Commerce, shipments of laboratory glassware totalled $30,155,000 in 1960. Jack Connelly, Kimble Glass Co. plant manager, predicts that by 1970 the market will be twice that size. With this expansion in mind, Kimble last month put into production the world's largest automatic glassblowing machine of its type.



The 3-story high, $1.5-million paste mold machine was designed by the Owens-Illinois subsidiary to produce thin-walled, seamless laboratory glassware. Various shapes and sizes of this ware are shown (above) emerging from the new machine with moil attached. On the way to final processing, moils are burned off (left). Once the pour-out spout operation has been completed, the ware goes to a specially developed decorating machine (below) which applies the brand name and marking spot with size identification. The decotated

ware is then ready to go into the lehr to be annealed (left), the final step in the manufacturing process.

Planning for this unique machine began in 1958 at the Kimble mechanical engineering department in Toledo, O. Over 3000 drawings were required for the massive machine and its auxiliary equipment (which have a mile-long maze of wiring and 5000 parts excluding nuts and bolts). After 10,824 man-hours of designing and construction, the completed 60-ton machine was disassembled and loaded on four trucks for the 10-day trip from Alton, Ill., to Kimble's Vineland, N. J., plant where it is now in operation.

Fig. 1. Large chunks of pegmatite rock, broken loose by blasting, are split by crane with an iron ball. Fragments are shoveled into truck.

FELDSPAR By Flotation

The Middletown, Conn., plant of the Feldspar Corp. has been in operation since January, 1961, and is currently producing 4500 tons of feldspar per month, with an ultimate capacity of 7000 tons, plus 3500 tons of sand and 600 tons of mica, both sold as by-products. This is the only plant in the Northeast which produces feldspar by the flotation method.

Directly south of Middletown and east of Portland, Conn., the plant is on a 400-acre tract of land containing pegmatite, of which about 0.2 per cent is iron (0.05 per cent after process); 60 per cent, feldspar; 37 per cent, silica; and 3 per cent, mica. The mining operation begins by breaking the pegmatite rock with conventional blasting and iron ball techniques (Fig. 1), after which the ore is trucked from the highest point of the open mine down to the first stage of the plant. This is a shed-like (Fig. 2) structure that houses a primary jaw crusher—two vertical parallel steel plates, one stationary, the other, vibratory—for reducing the mineral to 3-in. size.

From here the ore is transported by conveyor belt to a Symons secondary cone crusher, consisting of two inverted, open-end cones, one inside the other with ¾-in. space between their walls. The rock is squeezed between the cones, with the rotating motion of the inner cone crushing 1000 tons of mineral to 1-in. size every 8 hours.

The mineral is then carried to an outside, semicircular deposit by a mobile conveyor that can be wheeled in a 180° arc (Fig. 3). Under this outdoor deposit are three reclaiming tunnels. The operator can open one of several trap doors directly under the pegmatite rock which lead to the tunnel and in this way deplete the stockpile from a number of stations. The trap doors permit the mineral to fall directly onto individual conveyor belts, each of which leads to a single main conveyor that in turn deposits the pegmatite in a 1000-ton surge bin where it is stored. From here, the mineral enters the plant, ready for processing, at the rate of 22 tons per hour. It is conveyed directly to a 20-mesh rod mill equipped with 2½-in. steel rods (two rods wear out every 24 hours) which roll over each other as the mill rotates. After this grinding operation, the pegmatite passes through a Denver 16-mesh spiral screen cylinder which is mounted on the end of the rod mill discharge flange and revolves at the same speed as the rod mill. The screen permits 99.5 per cent of the pegmatite rock (0.033 in. in diameter) to penetrate. Ground fraction coarser than 20 mesh will not go through the screen and is admitted to a second rod mill for further grinding.

Now uniform in size, the pegmatite washes by gravity flow into a bowl classifier—one vat inside another (Fig. 4). As the water solution enters the inner bowl, heavy materials stay at the bottom, and the clay and slime float to the top, spilling over into the outer bowl. (The clay and slime are piped to one of several settling ponds about a ½ mile distant from the plant. As any one pond fills up, the residue is allowed to dry and is then cleaned out by power shovel.)

At the same time, the solution of materials—feldspar, iron, sand, and mica—is forced by diaphragm pump from the inner bowl up to the top of a centrifugal cone which separates the liquid from the solids. These solids are then introduced into the actual flotation process, and it is here that the plan differs from any other feldspar operation in the Northeast.

The flotation area consists of three sets of "cells," the first of which extracts from solution the mica, the second, the iron, and the last one, the feldspar. Before entering each cell, the pegmatite solution is introduced into a conditioner—a round tub in which special reagents are added.

First Cell—Mica

Reagents: sulfuric acid, fuel oil, pine oil, fatty acid amine. Reagents are actively combined with pegmatite solu-

Fig. 2. Rock is transferred down hill to primary jaw crusher which reduces the mineral to 3-in. Secondary cone crusher reduces rock to 1-in.

Fig. 3. Mineral is deposited by mobile conveyor in a 180° arc under which are three reclaiming tunnels that lead to 1000-ton surge bin.

tion in a "conditioner," or round tub, prior to being introduced into the first set of cells. Actually, what happens is that the reagent coats each particle of mica and causes it to be nonwettable. An impeller at the bottom of the cell is constantly turning and forces air bubbles to the top. The mica becomes fastened to these air bubbles and floats on top as a froth (Fig. 5). At the same time, a scraper draws the frothing mica into a water-fed trough (left, foreground). The pure mica is cleaned and stored separately.

Second Cell—Iron

Reagents: *sulfonate oil, fuel oil, pine oil, sulfuric acid, emulsified petroleum product.* Same type of action takes place, only this time, iron particles float to the top, are scraped off, and discarded.

Third Cell—Feldspar

Reagents: amine, fuel oil, pine oil, hydrofluoric acid. Final flotation step. Feldspar is scraped off the top, and silica is piped from the bottom to a storage tank.

The feldspar flows, in water, to a cleaning cell which uses the same principle as the first three cells, except that no further reagents are added. Finally, the feldspar flows into "scrubbers" or conditioners to which caustic soda has been added. The scrubbing action, along with the caustic soda, removes the reagents from the particles of feldspar which, when cleaned, are pumped to the top of one of six drainage tanks. The water filters down through the already deposited mineral, draining off at the bottom. If there is more than 0.05 per cent iron in the feldspar by laboratory test, it is introduced into a magnetic Exolon separator for further reduction of the iron content.

As a final step, the feldspar, mica and silica are each stored in bins of 120-ton capacity. From here they are shipped by 20-ton capacity hopper bottom trucks, and by hopper railroad cars.

The main office of Feldspar is in Spruce Pine, N.C.; additional plants are in Burnsville, N.C., Erwin, Tenn., and Monticello, Ga. In addition to the one in Middletown, Conn., the company has mines in Western, N.C., and Jasper County, Ga.

Fig. 4. The bowl classifier. Pegmatite solution enters inner bowl. Clay and slime spill over edge into outer bowl and are piped to settling pond.

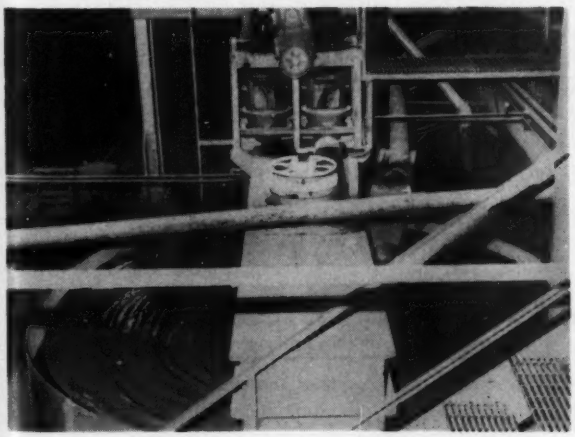
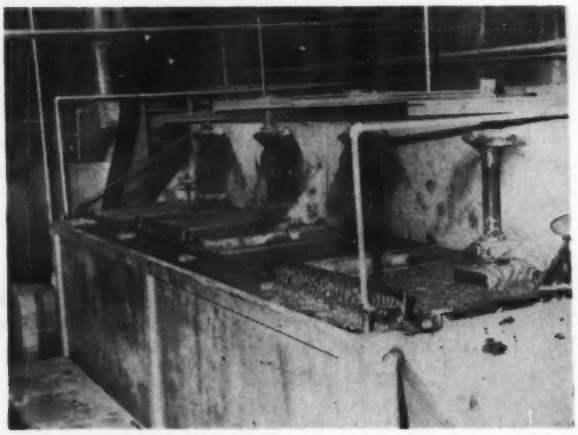


Fig. 5. The mica cell. Scraper draws off the frothing mica, depositing it in trough in foreground. Mica is then cleaned and stored separately.



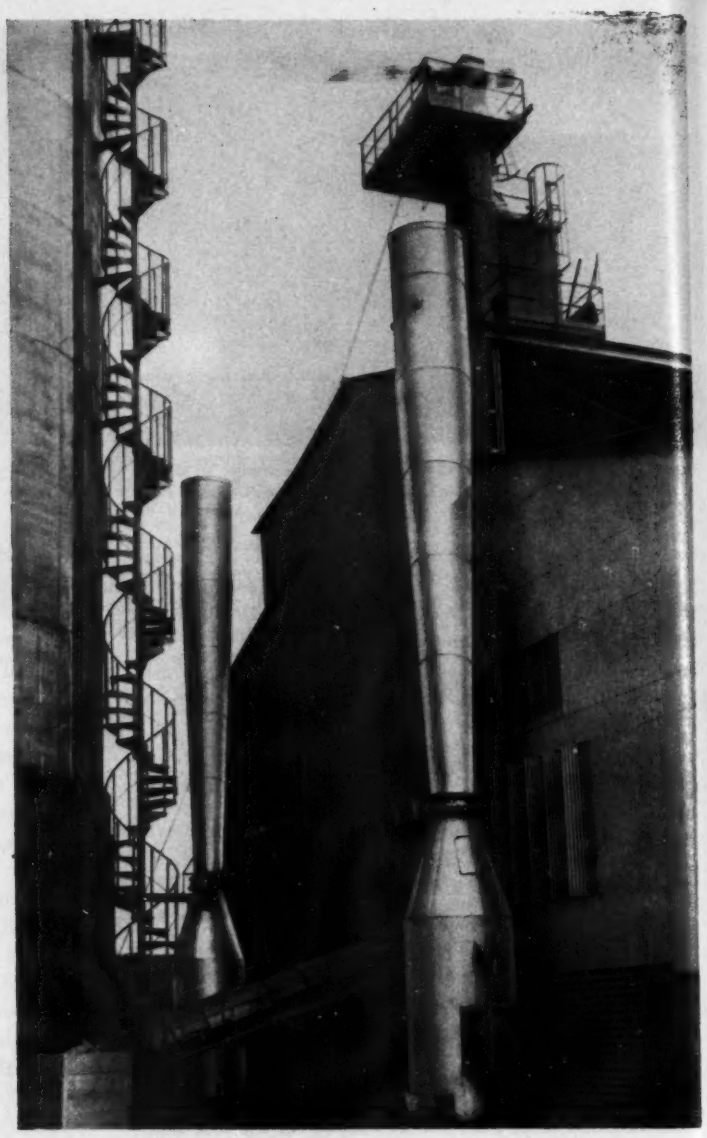
a record breaking

254,036 tons

in 1773 days

with

MORGAN-ISLEY FURNACE SYSTEMS



The Morgan-Isley System with secondary regenerators pictured here is installed on the furnace of Glass Containers Corp., in Hayward, California. This furnace melted record-breaking tonnage with a melting area of 676 square feet and an average fuel consumption of 5,979 cubic feet (natural gas) per ton. Morgan-Isley System provided the method of maintaining both furnace pressure and furnace firing at optimum conditions thus producing maximum yield and improved furnace operation. Performance pays off with Morgan-Isley Systems.

MORGAN WORCESTER

C2

MORGAN CONSTRUCTION CO.

WORCESTER, MASSACHUSETTS

ROLLING MILLS • MORGOIL BEARINGS • WIRE DRAWING MACHINES • COMBUSTION CONTROLS

Twelve years ago only a few industries were working with epoxies or had even heard the name; today, most industries are using them in some form or other, and almost all technical people are aware of them.

EPOXY-GLASS LAMINATIONS

by John M. Jewell,

Manager, Marketing Services, Conap, Inc., Allegany, N.Y.
PHOTOS COURTESY PROTECTIVE PLASTICS LTD., ONTARIO, CANADA

There is general agreement that epoxies are not miracle materials, but rather, are a superior member of the plastics family whose real value comes into focus only when they are used sensibly within their physical, electrical, and chemical parameters. The intent of this article is to (*1*) point up one method by which certain operational characteristics of epoxies are improved when combined with a second material, glass fabric, (*2*) explain the reasons for this combination, and (*3*) highlight certain of the proven applications.

Although the combination of epoxies and fiber glass is still new, there has been enough progress to indicate a positive, continued success; however, as is often the case, this success will not depend on laboratory work alone, but will be shared by the on-the-job user who has enough vision and courage to try a new material for a new job, in which only he believes it will perform satisfactorily.

An epoxy is a reaction product of epichlorohydrin and a polyhydric phenol, known as Bisphenol A, which, when combined with a suitable cross-linking agent, polymerizes to a thermosetting solid. In other words, an epoxy generally consists of two liquids, one a base, the other, a hardener. When mixed, they cure to a dense, infusible mass having unusual operating characteristics, such as linear shrinkage in the range of 1.0 to 1.5 per cent, tensile strengths reaching 10,000 psi, adhesion to multimaterials (far above average), water absorption less than 1.0 per cent after 24-hour total immersion, excellent electricals, and good impact resistance.

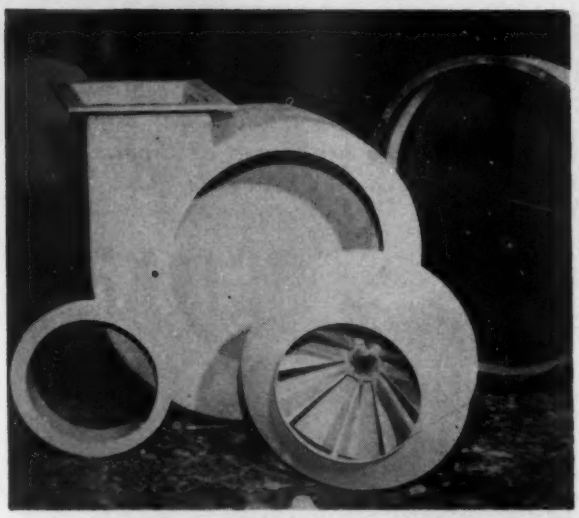
Why Epoxies?

What are the basic reasons for using epoxies with glass fabric? The most important one seems to be the ability of an epoxy to "wet" glass and provide almost inseparable welds. Even when two solid sections of glass have been bonded with an epoxy—and this is later broken—it will be found that failure usually occurs in the glass itself, rather than through lack of adhesion or cohesion of the epoxy. Secondly, supporting an epoxy with a very strong fibrous material, like glass fabric, greatly improves the inherent mechanical advantages of that epoxy; for example, a 10- to 12-ply laminate of glass cloth in hand lay-up, with a room temperature cure epoxy, offers compressive strengths of 35,000 psi, a tensile strength of 44,000 psi, and a flexural strength of 38,000 psi. These strengths average out to at least four or five times greater than those of a comparable section of unsupported resin. If the laminate is cured under heat and pressure, these characteristics are improved even more, with flexural strengths, for example, reaching as high as 60,000 psi. Thirdly, since most glass fabrics are adapted to hand forming, it is possible, when combining them with an epoxy, to make complex shapes without the aid of special tools, thereby drastically reducing machining costs and production delays.

Geodesic radome in Northern Canada. Triangular areas of glass cloth laminate are fastened together with epoxy resin.

Fabrication

The actual fabrication of a piece by hand lay-up methods is not a complicated process, nor is it a simple one. Certain procedures must be followed, whether the part is a housing for electrical components, a forming die, a spray mask, or a mold for casting duplicate parts. In almost all cases, a model is required for the lay-up,



Fans used to exhaust chemical fumes are constructed of fiber glass to withstand corrosion.

and generally, this can be made of metal, wood, plastic, plaster, clay, or fiber glass.

FIRST STEP. Prepare the surface of the model with a mold release so the cured piece can be removed.

SECOND STEP. If exact detail must be reproduced, as when making a mold, coat the surface with a paint-on application of a surface, or "gel," compound which, being thixotropic, eliminates excessive sag and run-off.

THIRD STEP. Form a fillet in sharp recesses with a paste made by mixing the gel coat and finely chopped glass fiber, so that the next layers of cloth will lay up evenly.

FOURTH STEP. Before the gel coat has hardened—while it is partially cured but still tacky—apply a layer of cloth roughly precut to size and form it to the surface by hand, gently pressing it into the gel coat. At the same time, smooth out the wrinkles and air pockets.

FIFTH STEP. Brush on a thin coat of the laminating compound (lower viscosity than the gel coat), then apply a second layer of cloth and again smooth by hand or brush. The laminate can be built up by using successive layers of laminating compound and glass cloth. Depending on strength, weight, and thickness criteria, the fabric can be glass, glass mat, or even chopped glass fiber, the latter being applied by special gun.*

SIXTH STEP. If the piece is a large checking fixture, and greater dimensional stability is needed, back the laminate up with masonite in an egg-crate design and set it in place with the gel coat, liberally filleting the bond edges with a gel coat/glass fiber putty. Even greater strength (but at a sacrifice in weight), is possible by filling the back of the laminate with an epoxy casting compound. In any event, the glass cloth should have a Volan A finish and an open weave to insure thorough penetration of the plastic through the cloth.

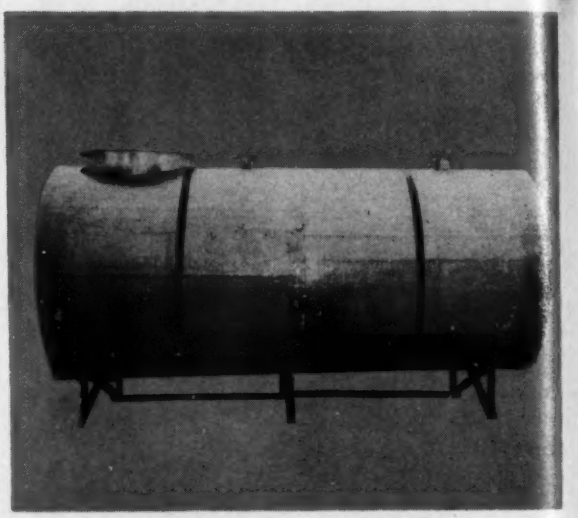
*See "Sprayed Reinforced Plastics," THE GLASS INDUSTRY, 42 (October, 1961), 581.

Fields of Application

Covers for Pickling Tanks

The diversity of both proven and potential applications is even now quite substantial. In covers for pickling tanks, glass and epoxies (both have exceptional resistance to chemical corrosion) combine to form durable, lightweight structures. Such covers have been made in sections that, when bonded together, cover an overall area 200 ft. long by 10 ft. wide. Sometimes, to decrease the weight factor in large fabrications of this nature, a honeycomb core is used with a laminated skin.

One of the most popular core materials is an all-wood, plastic-impregnated Kraft paper which offers an extremely good strength-to-weight ratio. In some cases such a sandwich panel will support 10,000 times its own weight, at the same time giving improved thermal and



Corroded metal chemical tank has been wrapped with fiber glass-epoxy resin to restore it to excellent condition.

acoustical insulation. Toughness and resistance to impact is also a prime offering; for example, a glass-epoxy laminate less than ½ in. thick, made by hand lay-up, withstood the direct blow of a 38-calibre, 158-grain bullet. Although the bullet had a velocity of 800 ft. per second and was fired less than 3 ft. from the panel, surface penetration was not discernible, and markings were easily wiped away.

Ladders

Another unique application is in the manufacture of ladders which are made with glass cloth and epoxy resin laminated around a light weight, unicellular plastic foam core. The ladder will not warp, it resists severe weathering, and will insulate against electricity. This type of construction, it is estimated, offers twice the bending strength of maple, with a weight savings of 30 per cent.

(*Continued on page* 711)

Glass makes its *mass market* appeal because people all up and down the line agree that beverages "from glass" look and taste better to the thirsty. Helping glass people meet the mass market for beverages is a job Diamond likes to do well—through **(1) Absolute purity and uniformity of Diamond Soda Ash. (2) Service and deliveries of soda ash best suited to the industry. (3) Diamond technical assistance.** Diamond leadership in "chemicals you live by" is nowhere better symbolized — or more important — than in its service to the glass industry. Diamond Alkali Company, Cleveland 14, Ohio.

Diamond Chemicals

NEWS
IN THE GLASS INDUSTRY

Corhart Refractories Co.

JOHN K. MEYER, vice-president, named assistant to company president EDWARD C. LEIBERG . . . HAROLD W. BAQUE, vice-president will represent the firm on the West Coast, with headquarters in Lagua Beach, Calif. . . . BENJAMIN P. COLOSKY, formerly staff sales manager, appointed general sales manager . . . JAMES E. AKER, supervisor of marketing services, refractory products, for Corning Glass International. S. A., will be headquartered at Corhart in Louisville, Ky. He will coordinate the sale and service of refractory products to overseas customers for Corning and Corhart, its wholly-owned subsidiary.

Diamond Alkali Co.

JOHN S. CORT, JR., appointed general sales manager for the soda products-chrome division . . . ANDREW M. ROEMER succeeds Cort as manager of chrome chemical sales.

Brockway Glass Co., Inc.

Construction is under way on the new general services building at the firm's main plant in Brockway, Pa. The 29,000-sq.-ft. facility is scheduled for completion by May 15, 1962. With additional expansion planned, this installation will house the new electronic laboratory, quality control, bottle design, photography, art, and several other departments.

Selas Corp. of America

KENNETH A. KIRBY appointed director of industrial relations. He was previously associated with Penn State University, York-Hanover Corp., and Caterpillar Tractor Co., Inc.

Minneapolis-Honeywell Regulator Co.

DONALD B. SHARMON and JACK PHILLIPS named industrial sales managers in San Francisco and San Diego, Calif., respectively . . . WILLIAM N. WALLACE is account executive for scientific sales in Santa Clara, Calif. . . . The firm's Philadelphia-based instrumentation education center is offering two new courses for 1962: control dynamics and fundamentals of instrumentation.

Allied Chemical Solvay Process Div.

ERNEST K. LEINS appointed manager for the West Coast sales branch. He succeeds JOHN W. PRIESING, who has been made assistant manager of the New York sales branch.

Kaiser Refractories & Chemicals Div.

GEORGE C. DAVIS, JR., appointed director of technical planning. He had been serving as director of technical services . . . RUSSELL E. PARDEE, formerly manager of technical services in the metallurgical field, named manager of technical services, with headquarters in Oakland, Calif. . . . WILLIS F. GEIB, a founder of Mexico Refractories Co., died September 21 at the age of 71. Mexico merged with Kaiser in 1959 . . . Construction is scheduled to begin this month on the $1,625.00 advanced refractories products facility to be erected adjacent to the company's Moss Landing, Calif.. seawater periclase plant. The new installation is expected to be in operation by midsummer of 1962.

Gibsonburg Lime Products Co.

JAWES E. GARN elected vice-president, sales, and VIRGIL S. TADSEN, vice-president, research and development. The firm manufactures and distributes dolomitic lime and stone products for use in the glass industry.

Anchor Hocking Glass Corp.

NORMAN J. OLGIVIE named director of research and engineering, with headquarters in the company's new research and engineering laboratories nearing completion at Lancaster, O.

Knox Glass, Inc.

ROBERT E. NORTON and DAVID DEERING BRACKETT have joined the company's sales staff. Norton was previously with Crown Cork & Seal Co. and Anchor Hocking Glass Co., and Brackett was formerly associated with Armstrong Cork Co.

Foote Mineral Co.

ROLAND R. VAN DER BECK has joined the company as manager of ceramic research. He was formerly assistant manager of the technical branch, Carborundum Co. refractories division. In his new position, he will direct investigations of the use and beneficial effects of lithium compounds and minerals in glass and ceramics.

FINANCIAL DATA

9 Months Ended September 30

American Potash & Chemical Corp.

	1960	1961
Net Earnings	$ 3,745,192	$ 3,160,162
Net Sales	$ 38,250,153	$ 33,858,963

Armstrong Cork Co.

	1960	1961
Net Earnings	$ 4,186,000	$ 4,876,000
Net Sales	$ 75,531,000	$ 78,160,000

Corning Glass Works

	1960	1961
Net Earnings	$ 17,580,000	$ 18,481,194
Net Sales	$165,481,036	$170,115,129

Diamond Alkali Co.

	1960	1961
Net Earnings	$ 10,459,000	$ 7,845,000
Net Sales	$113,421,000	$108,758,000

Foote Mineral Co.

	1960	1961
Net Earnings	$ 501,578	$ 264,260
Net Sales	$ 13,188,597	$ 11,840,052

Owens-Illinois Glass Co.

	1960	1961
Net Earnings	$ 26,653,395	$ 24,406,341
Net Sales	$430,707,387	$440,076,223

Pittsburgh Plate Glass Co.

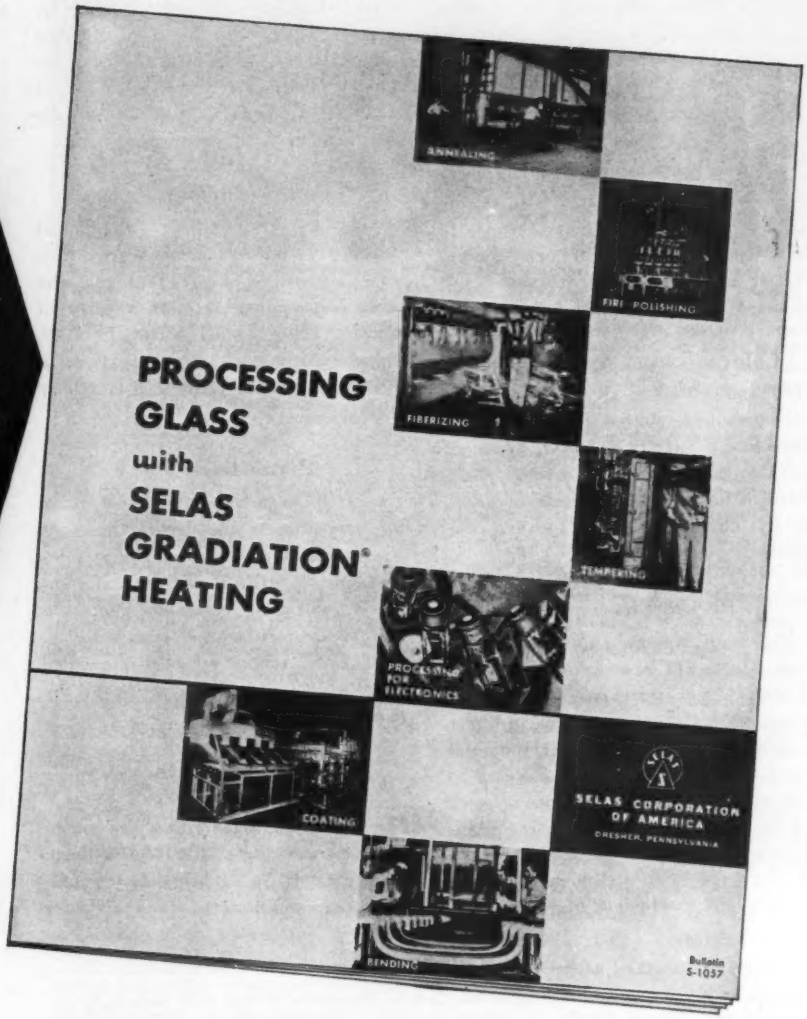
	1960	1961
Net Earnings	$ 38,101,121	$ 23,317,134
Net Sales	$482,217,227	$439,172,025

Wyandotte Chemicals Corp.

	1960	1961
Net Earnings	$ 3,621,000	$ 3,350,000
Net Sales	$ 73,785,000	$ 75,170,000

NEW SLANTS ON HEAT PROCESSING FROM SELAS

you'll want this idea starter!



If you are looking for better ways and means to improve production methods, *and save money too*, here's an idea source guaranteed to spark your imagination and provide a wealth of hints, tips, and suggestions.

This 20-page Selas bulletin contains complete descriptive data on how GRADIATION® heating can he'p you in a variety of glass industry operations . . . from annealing to tempering . . . from fire-polishing to processing for electronics. Comprehensive drawings, diagrams, and photographs are profusely used.

Would you like a free copy? Simply write to Ceramic and Glass Division.

SELAS CORPORATION OF AMERICA
1412 Dreshertown Road, Dresher, Pa.

EUROPEAN SUBSIDIARY: Selas Corporation of America, European Div., S.A., Pregny, Geneva, Switzerland. **INTERNATIONAL AFFILIATES**: Australia, Benelux, France, Japan, Portugal and Spain.

GRADIATION is a registered trademark of Selas Corporation of America.

SELAS

HEAT AND FLUID PROCESSING ENGINEERS
DEVELOPMENT / DESIGN / CONSTRUCTION

Libbey-Owens-Ford Glass Co.

GEORGE E. BENNETT, former reporter and TV editor, *Huntington* (W.Va.) *Advertiser*, has joined the press relations section. The L-O-F press relations section, managed by Everett Eakin, is a part of the company's public relations division, headed by James M. Ashley, vice-president, public relations.

Armstrong Cork Co.

D. B. TINGLE assigned to the newly-created post of assistant general manager and director of marketing for the company's international opeartions. He has been vice-president and general sales manager of Armstrong Cork Canada Ltd. since 1953.

Colorado Fuel & Iron Corp.

LEONARD C. ROSE, formerly executive vice-president, elected president and a director . . . ALWIN F. FRANZ, president of the firm since 1952, named chairman of the board . . . CHARLES ALLEN, JR., is chairman of the executive committee.

Perkin-Elmer Corp.

Solid State Materials Corp., East Natick, Mass., will be acquired by Perkin-Elmer. Under the plan approved by boards of both companies, Perkin-Elmer will acquire 80 per cent of the capital stock of SSM, with SSM continuing to operate under its present management as a separate subsidiary of Perkin-Elmer. SSM was organized less than 2 years ago to specialize in the development and production of exotic solid state crystals, among the important uses for which is the new field of optical masers in which Perkin-Elmer is active.

General Electric Co.

A new diamond application development laboratory has been put into operation by the metallurgical products department. The facility has been set up to investigate new and improved diamond applications and to evaluate new man-made diamond types.

Stauffer Chemical Co.

RALPH P. GATES, director of technical service, Victor Chemical Works division, succeeding L. E. JACKSON who retired November 1, after 3 years of service. Gates joined Victor in 1949, became director of special products in 1960, and administrative assistant later that year.

Permaglass, Inc.

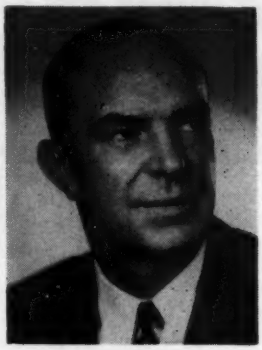
JOSEPH C. RYAN appointed sales director, reporting to the general manager . . . ROBERT C. KOHL continues as sales manager . . . PAUL A. ERICSON, sales engineer, will have additional duties in that area, or in market research . . . ROBERT R. FLICK, recently appointed sales engineer, will be active in the marine and other fields.

Glass Container Industry Research Corp.

The 5-year-old organization has added to its membership Castle-Hanson Corp. of Rochester, N. Y., bringing membership representation of total industry manufacturing capacity to over 60 per cent. Present officers of the GCIRC include F. B. HESS (president, Brockway Glass Co.), chairman; DR. A. L. JOHNSON, president; W. J. GREEN (chairman, Thatcher Glass Mfg. Co.), vice-president; R. R. BOARD (vice-president, Foster-Forbes Glass Co.), treasurer; JOHN P. FARIS (vice-president, Laurens Glass Works), secretary.

Owens-Illinois Glass Co.

RAYMON H. MULFORD elected president, succeeding CARL R. MEGOWEN who has been named vice-chairman of the board and chairman of the executive committee. Mulford has been executive vice-president of the company since 1960 and was made a director last April . . . DR. T. ROBERT SANTELLI is director of organic research and DR.



Raymon H. Mulford

J. M. TEAGUE, JR., director of inorganic research, in a reorganization of corporate research and development activities. A third post, director of fundamental research, is to be filled in the near future. PAUL L. AMES heads research administration for all three groups . . . ROSS D. BARTSCHY appointed manager of the glass container division's Columbus, O., branch. He succeeds KEN ROETHLISBERGER who was recently transferred to the division's Midwestern staff in Chicago . . . ROBERT C. SHACKLEFORD assigned to the division's new Tampa, Fla., office . . . ROLAND W. MUELLER named supervisor of production planning and inventory control in the Libbey Glass division, with headquarters in Toledo, O.

G. P. Patel & Co.

Is planning to construct a glass manufacturing plant with annual output of 3600 tons of pressed and blown glassware. G. P. PATEL of that firm has

Present at the 28th annual meeting of the Ceramic Association of New York were (l. to r.) F. P. Bundy, General Electric Co., Schenectady; A. C. Saunders, Electro Refractories and Abrasives Corp., Buffalo; Prof. Robert M. Campbell, College of Ceramics; W. A. Lambertson, Carborundum Co., Niagara Falls; Karl H. Sandmeyer, Harbison-Carborundum Corp., Falconer. More than 800 members representing 32 firms attended the meeting at Alfred University.

written that he would like an interested American company to write him in order to set up an arrangement for providing *(1)* technical collaboration, *(2)* financial investment, and *(3)* equipment for the plant. The company was previously an importer of glassware but restrictions have been imposed, with the result that they wish to enter the manufacturing line. Patel's address is Mansur Building, 98, Princess St., Post Box No. 2433, Bombay 2, India.

National Bureau of Standards

DR. THOMAS R. LAWRENCE, a member of the engineering metrology section, appointed to the bureau to investigate the applicability of the helium-neon gaseous optical maser to precision measurements of length.

Joseph B. Blandford

B. F. Drakenfeld & Co.

JOSEPH B. BLANDFORD, JR., has joined the staff of the firm's Washington, Pa., plant and laboratory.

Rare Earth Study

Under the sponsorship of the Molybdenum Corp. of America, a new research project on the uses of rare earth elements has been set up at Pennsylvania State University. The program will concentrate on the uses of cerium, lanthanum, praseodymium, neodymium, gadolinium, europium, and samarium. "Sufficient work has been done in the steel, iron and glass industries," said Marx Hirsch, MCA president, "to indicate the early acceptance of rare earth compounds in these industries. However, in the use of individual rare earth elements, research into uses for the separated metals holds the key to the future." While the rare earth elements are receiving considerable attention in space applications, other important uses include those in atomic radiation absorbing glass, refractories, specialized ceramics, high-temperature resistors, and portable radiation equipment. Director of the research project at the university is H. Beecher Charmbury, head of the department of mineral preparations. The work is under the general supervision of Dr. David R. Mitchell, chairman, Division of Mineral Engineering, College of Mineral Industries.

Dinner guests during the Ferro Symposium in Pittsburgh. Back row, (l. to r.): Joe Young, Jack Thompson, and Jim Haslup, Knox Glass; Bob Jones, Liberty Glass; Joe Swigart, manager, Pittsburgh plant, Ferro Corp. color division; Bill Morgan, Owens Illinois; Henry Williams, Thatcher Glass; Francis Kay, Laurens Glass; and John Nordan, Knox Glass. Front row: Frank Child, THE GLASS INDUSTRY; Hager Wrinkle and Bill Higdon, Chattanooga Glass; Lyndy Lauber, Armstrong Cork; Bill Ward, Lamb Glass; and Bob Weis, Ferro Corp. Others who attended symposium but are not in picture include Ralph Rodenbaugh, Glenshaw Glass; Charles Doolittle, Brockway Glass; and Earl Schaefer, Owens Illinois.

Symposium on Glass Colors

Representatives of ten glass container manufacturers attended a symposium on glass colors, presented by Ferro Corp. at their Pittsburgh plant, on October 27. The purpose of the all-day meeting was to introduce the company's resistant glass enamels for labeling returnable soft drink bottles.

J. J. Swigart, Pittsburgh plant manager, welcomed the visitors, explaining the scope of Ferro's operations in general, and the nature of its work, specifically, in the glass decorating field. After a tour of the manufacturing facilities, in order to see the frit and enamels being made, the group visited the research department, where the symposium was held.

At the symposium, Dennis Smith, glass superintendent, color laboratory, and Aladar Burgyan, manager, color division research laboratory, both from the main Cleveland plant, discussed the new enamels in detail, explaining how they differ from previous enamels and how they compare with others on the market. Following the symposium talks, the meeting was opened for discussion, and the decorators asked questions concerned with problem areas in regard to application, firing temperatures, etc.

The next day the visitors attended the Pitt-Navy football game and were guests at a special dinner Saturday evening. During the dinner, the decorators, meeting as individuals, discussed the need for a greater exchange of information and mutual cooperation in order to develop further the decorating field as an industry. They stressed several times that the purpose of decorating a glass container is to make it even more attractive and more salable; therefore the decorating field has become an increasingly important segment of the glass container industry.

We've Moved

Our new address is

Ogden Publishing Group
Magazine Publishing Div.
Reuben H. Donnelley Corp.
466 Lexington Ave.
New York 17, New York
ORegon 9-4000

NEW APPLICATIONS IN GLASS...

Radiation-shielding glass portholes were first shown at the Atom Fair in Chicago last month.

FALLOUT SHELTERS: Glass Solves a Major Problem of Survival

► The psychological strain of confinement in fallout shelters can be eased by the use of radiation-shielding glass windows in above-the-ground and basement shelters. The solid piece of clear glass is denser than ordinary concrete, and therefore offers more resistance to radiation than the walls of the shelter themselves. Providing full visibility, this special glass, unlike conventional types, will remain clear after exposure to radiation.

For an above-the-ground shelter, the window assembly includes a concrete frame, sealed around the length of the glass, and a separate concrete casing. Single-step construction of both frame and casing precludes dangerous radiation leakage and insures positive seating of the window. A double dust seal is made by fastening a gasket and steel retaining frame on the inside end and caulking the outside end.

Use of a separate casing allows the window to be installed after the masonry work has been completed. The casing is cemented in the shelter wall and the framed window inserted from the outside. Stepped construction prevents the window from being removed from the outside; the retaining frame prevents it from being pushed or blown inside.

Designed for public and family shelters, the windows are available in standard thicknesses of 16, 18, 21, 24, and 36 in. The glass itself is 4 in. square and the entire unit—glass, frame, and casing—measures 7⅝ in. by 7⅝ in. (half the size of a standard concrete block). The 24-in. window with frame and casing is priced under $100. For basement shelters, the same glass is available without frame and casing at the cost approximately of $35 for a piece fitting an 8-in. thick. *Corning Glass Works.*

Reader Service Card: Circle No. 50

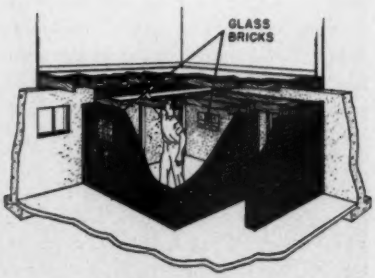
► A solid glass brick brings natural daylight into fallout shelters without sacrificing protection against radiation. According to Civil Defense authorities, light is one of the most essential requisites for shelter living, ranking immediately after the absolute necessities of air, water, and food. The admission of available natural light would not only allow the performance of certain tasks and ease the strain on limited battery-powered light sources, but would also be an important morale factor to those living in the shelter.

The most significant feature of the glass shelter bricks is that the density of the material—149 lb. per cu. ft.—is equal to that of solid concrete. This density, or mass, is the key factor in stopping deadly gamma radiation. In addition, the solid glass bricks are annealed during production for exceptional strength. When substituted on an inch-for-inch-thickness basis for concrete, these bricks meet Civil Defense requirements, and would be installed back-to-back in a wall for maximum protection.

Glass bricks are now being produced in two sizes: 5 in. by 5 in. by 2⅝ in. and 8 in. by 8 in. by 3 in. Edges are plastic-coated to provide a better bond with mortar. Compressive strength ratio is 80,000 lb. per sq. in. and modulus of elasticity is 10,000,000 lb. per sq. in. Estimated prices range from $3 to $4 for the 8-in. units and $1 to $1.25 for the 5-in bricks. *Pittsburgh Corning Corp.*

Reader Service Card: Circle No. 51

Fallout shelter windows are designed for do-it-yourself installation. Shown here is casing.



Glass bricks pick up daylight from outside at back of shelter, from cellar window in front.

Three layers of 3-in. thick bricks admit 54 per cent of light (one brick, 80 per cent).

NEW EQUIPMENT AND SUPPLIES

New Glazing Beads

Give the appearance of heavier commercial construction to light residential-type window sections. These metal beads permit the small glass manufacturer to branch into light commercial work by modifying his residential windows only slightly. Either of two types holds crystal and plate glass in the typical 1-in. aluminum window section. The first is a snap-in square bead, handy for on-the-job glazing because corners need not be carefully mitred. It is available in sizes for single- and double-strength glass, crystal, and plate. The second is a bead designed to act as a retainer for the glass which is thus surrounded on both sides with glazing compound. For larger pieces of glass, the bead may be fastened with a sheet metal screw through the top face as an added precaution. *Pemko Mfg. Co.*

Reader Service Card: Circle No. 52

Safety Coating Eliminates Flying Glass Hazards

A clear liquid called "Glastix" is claimed to prevent flying glass fragments when used as a protective coating on vacuum bell jars and other laboratory and industrial equipment. Easily applied by brush or roller, the compound dries rapidly to form a tough, transparent film. *Allen Plastics Corp.*

Reader Service Card: Circle No. 53

Metal Powder for Glass Mold Repair

New material has been developed for low-cost repairing with spray-type brazing torch equipment. Recommended for repair of nicks, cracks, or chips in mold edges, the powder requires no special skill for application. The nickle-base hard-surfacing compound can be easily formed and finished with a file. *Wall Colmonoy Corp.*

Reader Service Card: Circle No. 54

Special Thermometer for Glass

A new instrument called the "Thermodot" has a spectral response of 3.5 to 4.1 microns corresponding to the strong fundamental emission and absorption bands in silica glasses. The thermometer avoids the problems commonly associated with radiation and optical pyrometers which operate in regions where glass has high and variable transparency. A glass thickness control automatically corrects the entire temperature calibration, permitting accurate measurements on sections as thin as 0.025 in. *Radiation Electronics Co.*

Reader Service Card: Circle No. 55

Semiautomatic Splicing Machine

Seals various sizes of Pyrex or soft glass tubular spouts t funnels or bulbs. Eight- and 12-position machines have manual loading and unloading; 16-position machine operates automatically. Upper heads feature pneumatic universal chucks that grip and position spouts. *Kahle Engineering Co.*

Reader Service Card: Circle No. 56

Test and Calibration Console

Self-contained unit includes four complete sections for use with *(1)* recorders and indicators, *(2)* transmitters and transducers, *(3)* controllers, and *(4)* oscillators. All or any combination of the four sections can be used simultaneously. *Minneapolis-Honeywell Regulator Co.*

Reader Service Card: Circle No. 57

Standard Modular Elements for Semiconductor Production

"Do-it-yourself" equipment is now available for the manufacture of semiconductor and solid state devices such as transistors. These facilities previously had to be custom designed and produced. The modular approach allows sizeable capital expenditure reductions in the electronics industry, enabling smaller manufacturers to install semiconductor research and production facilities. It is also believed that the line will permit more rapid upgrading of technological facilities and expansion of production capacity. *Leybold Co.*

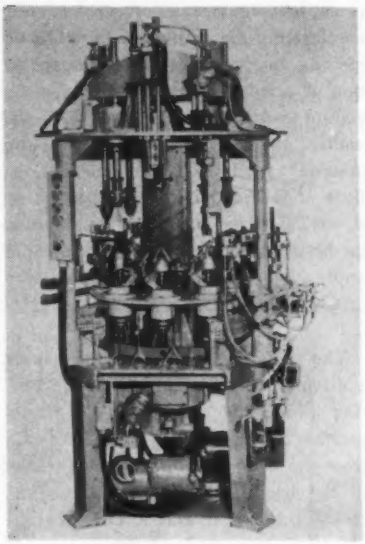
Reader Service Card: Circle No. 58

CATALOGS RECEIVED

New noble metal composite for glass industry (80 pages). Describes "Trilay," a material designed to provide long life and improved strength under high-temperature and corrosive conditions. Composed of a layer of powdered platinum metal alloy bonded between two outside layers of wrought platinum or platinum alloy, Trilay is used in the glass industry, on thermocouples, and for melting pots and laboratory ware. *Englehard Industries, Inc.*

Reader Service Card: Circle No. 59

Optical glass heat-treating furnaces (4 pages). Features both bench and floor models of new "Stabil-Glow" box-type furnaces with high-temperature electronic proportioning control system. *Blue M Electric Co.*



Kahle's new splicing machine.

Reader Service Card: Circle No. 60

Special items of interest to glassblowers (48 pages). Includes a number of new items and package quantity reductions. Flat- and round-bottom boiling flask blanks which have not been flame-worked are available for reflecking work. A total of 191 standard articles are listed. *Corning Glass Works.*

Reader Service Card: Circle No. 61

High-alumina brick (4 pages). Gives technical data on "Titan 50 Per Cent" and "Franco 60 Per Cent" brick. The first is for uptakes, division walls, and upper courses of checkers in glass tank regenerators, the second for port construction checkers and regenerators in container glass plants. *J. H. France Refractories Co.*

Reader Service Card: Circle No. 62

INVENTIONS AND INVENTORS

Furnaces

Method and Apparatus for Melting Glass. Patent No. 2,975,224. Continuation of application October 1, 1954. This application February 27, 1959. Issued March 14, 1961. Five sheets of drawings; none reproduced. Assigned to Owens-Illinois Glass Co. by Oscar G. Burch.

The principal object of the invention is to provide means for mechanically accelerating the motion of the glass in melting or other areas by the introduction of a fluid or bubble forming material or medium into the body of the molten glass. Preferably the bubbling material is introduced through the floor of the melter, thereby generating a vertical plane of accelerated motion in the glass body causing a more rapid approach to the desired homogeneity in the molten glass.

The vertical plane of motion causes a circular or elliptical convection current which not only improves homogeneity but moves the glass or batch from the colder portion of the furnace to the hotter portion where it is exposed to the heat source, thus promoting more rapid melting.

Still another objective is to provide an additional method whereby homogeneity in the glass body may be reached not only in greater volume but in shorter time intervals. This is accomplished by providing energized electrodes in various areas of the tank, but more specifically in the melter regions where, acting in combination with the radiant heat applied to the surface areas of the glass, they produce convection current movement in the body of the glass. This in conjunction with and supplemented by the mechanical action produced by the bubbling means, and operates to produce a more homogeneous body of refined molten glass in greater volume and in shorter time intervals.

There were 13 claims and 12 references.

Method of Melting Glass. Patent No. 2,958,161. Filed August 13, 1957. Issued November 1, 1960. Three sheets of drawings; none reproduced. By Delos M. Palmer.

A method of melting glass is described which consists in gravitating pellets containing the necessary ingredients for glass through an enclosed preheating zone.

The pellets are preheated to a temperature not exceeding 900°F with hot gases emanating from an enclosed melting zone maintained below the preheating zone. By employing a multiplicity of firing zones in the melting chamber and through the operation of a control valve, the regulation of the heat input into the firing zone is made possible for optimum conditions of melting the pellets as they completely melt in suspension on their way down to the shallow furnace bottom below. According to this design it is not necessary to have a large quantity of glass in the bottom of the melting chamber. This is conducive to safe operation. The pellets are melted for immediate use out of the furnace.

By melting the pellets under pressure, the fuel used and the size of the furnace are substantially reduced and quite high thermal efficiencies can be obtained. It is possible to have the furnace operating at a pressure of fifteen or more pounds per square inch gage having approximately one-sixth the size of glass melting furnaces presently in use. This furnace may operate at an efficiency of 50 to 65 per cent with complete safety.

One claim and the following references.

United States Patents

Re. 19,788, Amsler, December 17, 1935; *Re.* 20,828, Powell, August 16, 1938; 1,371,084, Ferguson, March 8, 1921; 2,025,799, Burgoyne *et al.*, December 31, 1935; 2,062,907, Jeffrey *et al.*, December 1, 1936; 2,509,390, Gaunder, May 30, 1950, and 2,634,116, Witt, April 7, 1953.

Feeding and Forming

Glass Batches and Method of Preparation. Patent No. 2,976,161. Filed November 2, 1956. Issued March 21, 1961. No drawings. Assigned to Corning Glass Works by Rowland D. Smith.

This invention relates to the preparation of glass batches in which glass cullet is a major constituent. It is particularly concerned with glass batches of this type in which the glass cullet employed is partially deficient in one or more necessary glass-making materials which must therefore be introduced into the batches in compensating amounts.

The invention is particularly advantageous as a means of improving glass fining by incorporating a fining agent in the cullet portion of the batch. The particular fining agent employed will be that customarily used in melting of the glass. Sodium chloride and sodium sulphate exemplify widely used fining agents which may be readily applied in aqueous solution. The oxides of arsenic and antimony, also extensively used for fining, may be applied in the form of certain soluble salts embodying these oxides. Where it is undesirable to use such salts, these oxides may be applied successfully in the form of a suspension or slurry, although, where a suspension is used, care must be taken to insure that the material is well mixed and uniformly applied.

Other materials which may conveniently be added in accordance with the present invention are glass fluxes such as the alkali metal oxides and boric oxide which form numerous water soluble salts. Also colorants such as copper oxide may be added in the form of soluble salts such as copper nitrate.

There were ten claims and the following references.

United States Patents

2,434,281, Moulton, January 13, 1948, and 2,473,958, Kreidl, June 21, 1949.

Foreign Patents

576,579, Great Britain, Apr. 10, 1946.

Other References

Tooley: *Handbook of Glass Manufacture,* published by Ogden Publishing Co., N.Y., 1953, page 253.

(*Continued on page* 712)

• CALENDAR •
OF COMING EVENTS

January 22, 1962

ACS NORTHWESTERN OHIO SECTION. Annual Meeting, Symposium, and Toledo Award Banquet. Award will be presented to Henry H. Blau, Federal Glass Co. Symposium topic is heat transfer phenomena in glass and ceramics.

January 22-25, 1962

PLANT ENGINEERING AND MAINTENANCE SHOW AND CONFERENCE. 400 companies to exhibit. Convention Hall, Philadelphia, Pa.

January 29-February 8, 1962

QUALITY CONTROL BY STATISTICAL METHODS. Fifteenth annual basic short course presented by the Division of University Extension. For further information, contact Professor John A. Henry, 130 Mechanical Engineering Building, University of Illinois, Urbana, Ill.

February 6-8, 1962

SPI 17TH REINFORCED PLASTICS DIVISION MEETING. Edgewater Beach Hotel, Chicago, Ill.

February 11-14, 1962

CANADIAN CERAMIC SOCIETY. Diamond Jubilee Meeting. Royal Connaught Hotel, Hamilton, Ontario, Canada.

March 14-17, 1962

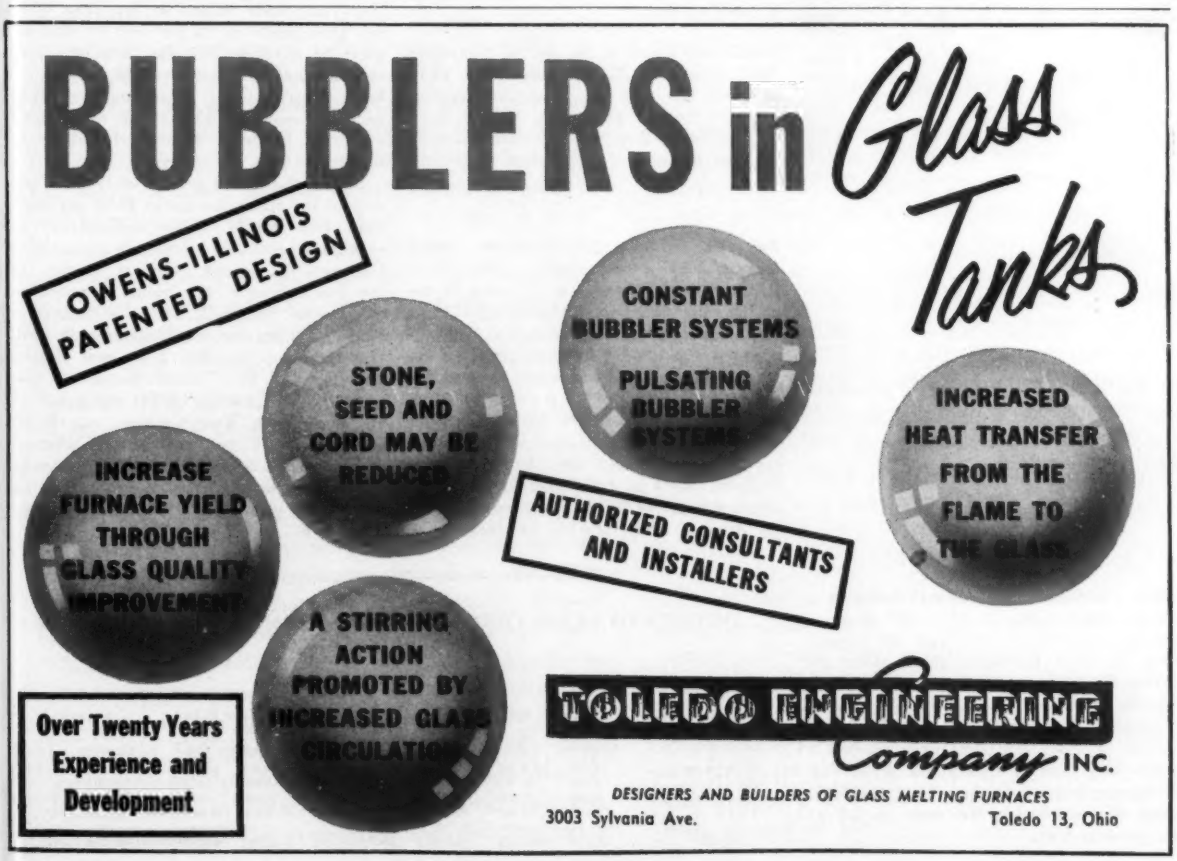
OPTICAL SOCIETY OF AMERICA. Spring Meeting. Mayflower Hotel, Washington, D. C.

June 6-8, 1962

AMERICAN SCIENTIFIC GLASSBLOWERS SOCIETY. Seventh Annual Symposium and Exposition. Ralph H. Russler, chairman. Papers should be submitted to Wellman Clark, Chairman, Paper Committee, Naval Ordinance Lab., White Oaks, Silver Spring, Md. February 15, 1962, deadline for 1-page abstracts; March 30, 1962, deadline for manuscripts. Sheraton Park Hotel, Washington, D. C.

July 8-14, 1962

SIXTH INTERNATIONAL CONGRESS ON GLASS. Sheraton Park Hotel, Washington, D. C.


BUBBLERS in Glass Tanks
OWENS-ILLINOIS PATENTED DESIGN
CONSTANT BUBBLER SYSTEMS
PULSATING BUBBLER SYSTEMS
STONE, SEED AND CORD MAY BE REDUCED
INCREASED HEAT TRANSFER FROM THE FLAME TO THE GLASS
INCREASE FURNACE YIELD THROUGH GLASS QUALITY IMPROVEMENT
AUTHORIZED CONSULTANTS AND INSTALLERS
A STIRRING ACTION PROMOTED BY INCREASED GLASS CIRCULATION
Over Twenty Years Experience and Development
TOLEDO ENGINEERING Company INC.
DESIGNERS AND BUILDERS OF GLASS MELTING FURNACES
3003 Sylvania Ave.
Toledo 13, Ohio

STATISTICAL POSITION OF GLASS

GLASS CONTAINER PRODUCTION AND INVENTORY

(All Figures in Gross)

		Production September 1961	Stocks September 1961
Food, Medicinal and Health Supplies; Chemical, Household and Industrial; Toiletries and Cosmetics.	Narrow Neck ..	4,887,000	6,904,000
	Wide Mouth .	*4,921,000	*7,021,000
Beverages			
Returnable		457,000	1,985,000
Nonreturnable		192,000	840,000
Beer			
Returnable		90,000	482,000
Nonreturnable		1,701,000	1,381,000
Liquor		996,000	1,777,000
Wine		416,000	795,000
Dairy Products		155,000	240,000
TOTAL		*13,815,000	*21,225,000

* This figure includes fruit jars, jelly glasses, and packers' tumblers.

GLASS CONTAINER SHIPMENTS

(All Figures in Gross)

Narrow Neck Containers

	September, 1961
Food	2,341,000
Medicinal and Health Supplies	1,185,000
Chemical, Household and Industrial	768,000
Toiletries and Cosmetics	840,000
Beverages	
Returnable	530,000
Nonreturnable	219,000
Beer	
Returnable	80,000
Nonreturnable	1,435,000
Liquor	856,000
Wine	401,000
Subtotal (Narrow)	8,655,000

Wide Mouth Containers

Food	*4,154,000
Medicinal and Health Supplies	329,000
Chemical Household and Industrial	125,000
Toiletries and Cosmetics	210,000
Dairy Products	163,000
Subtotal (Wide)	*4,981,000
Total Domestic	*13,636,000
Export Shipments	120,000
TOTAL	*13,756,000

* This figure includes fruit jars, jelly glasses, and packers' tumblers.

Glass Container Shipments during September, 1961, came to 13,756,000 gross, a decrease of 23.9 per cent from the August, 1961, figure of 18,094,000 gross. Shipments during September, 1960, amounted to 14,208,000 gross, or 3.2 per cent more than September, 1961. At the end of the first 9 months of 1961, shipments have reached a preliminary total of 126,017,000 gross. This is 4.5 per cent more than the 120,589,000 gross shipped during the same period of the previous year.

Glass Container Production based on figures released by the Bureau of Census, Industry Division, was 13,815,000 gross during September, 1961. This is a decrease of 16.3 per cent from the previous month's production figure of 16,521,000 gross. During September, 1960, glass container production was 12,938,000 gross, or 6.3 per cent less than the September, 1961, figure. At the end of the first 9 months of 1961, glass manufacturers have produced a preliminary total of 127,866,000 gross. This is 3.3 per cent more than the 123,709,000 gross produced during the same period in 1960.

Employment in the glass industry during August, 1961, was as follows. *Flat Glass*: a preliminary figure of 25,300 for August, 1961, indicates an increase of 4.5 per cent over the figure of 24,200 given for July, 1961. *Glass and Glassware, Pressed and Blown*: an increase of 1.8 per cent is shown by the preliminary figure of 91,200 reported for August, 1961, when compared with the adjusted figure of 89,400 for July, 1961. *Glass Products Made of Purchased Glass*: the preliminary figure of 13,400 given for August, 1961, is 1.5 per cent over the figure of 13,200 reported for July, 1961.

Stocks on Hand at the end of September, 1961, came to 21,225,000 gross. This is 1.4 per cent less than the 21,529,000 gross on hand at the end of August, 1961, and 6.2 per cent more than the 19,970,000 gross on hand at the end of September, 1960.

Payrolls in the glass industry during August, 1961, were as follows. *Flat Glass*: an increase of 5.5 per cent is shown by the preliminary figure of $13,840,143.63 given for August, 1961, when compared with the adjusted figure of $13,109,422.17 given for July, 1961. *Glass and Glassware. Pressed and Blown*: an increase of 2.7 per cent is shown in the preliminary $37,995,557.04 given for August, 1961, when compared with the previous month's adjusted $36,970,611.89. *Glass Products Made of Purchased Glass*: a preliminary figure of $4,529,432.22 was reported for August, 1961. This is an increase of 4.9 per cent when compared with the adjusted $4,315,979.98 for July 1961.

Turkish Window Glass is now on the market. The Cayirova Glass Factory, recently completed at a cost of $11.1 million, has introduced its first products. Annual production of the plant is expected to be 37,500 tons of 2-mm thick window glass, more than half of which will be exported. Domestic window glass consumption is 15,000 tons a year, and it is reported that Cayirova window glass will sell for 10 per cent lass than imported window glass.

Glass Christmas Tree Ornaments showed a 127 per cent increase in the number imported into the United States during the first 8 months of 1961, (a 50 per cent increase in value), as compared with the same period a year ago. The ornaments are classified in two groups, those which are less than $7.50 per gross and those over $7.50 per gross (see table). In 1961, imports of ornaments valued at less than $7.50 per gross totaled 826,825 gross (worth $862,015) as compared with 40,976 gross (worth $532,361 for ornaments valued at more than $7.50 per gross. In other words, of the glass ornaments imported the first 8 months this year, those valued at less than $7.50 per gross made up 95 per cent of total imports by quantity. In value, however, those ornaments represented about 60 per cent of total imports. Glass ornaments over $7.50 per gross made up 40 per cent of the total value (5 per cent of total quantity) of imports.

During the first 8 months of 1961, 75 per cent of the ornaments under $7.50 per gross came from Japan (largest supplier) at an average value of 67 cents per gross. West Germany, the second principal supplier of the less expensive ornaments, exported to the United States 12,223 gross, valued at $62,088, during the first 8 months of 1961. This represents less than 2 per cent of total imports into the United States of this category. The average price per gross of ornaments from West Germany was $5.14. The majority (81 per cent) of the Christmas tree ornaments valued at over $7.50 per gross were imported from West Germany during the first 8 months of 1961 at an average value of $12.14 per gross.

IMPORTS OF GLASS CHRISTMAS TREE ORNAMENTS IN GROSS AND U.S. DOLLARS

(First 8 Months)

	1961				1960			
	Over $7.50 per Gross		Under $7.50 per Gross		Over $7.50 per Gross		Under $7.50 per Gross	
Country	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
West Germany	33,081	$401,460	12,223	$ 62,088	30,826	$338,858	17,965	$ 74,667
Italy	2,611	50,836	—	—	3,894	53,067	31	111
Japan	1,685	23,102	622,462	416,856	3,969	44,446	233,506	193,305
Other	3,599	56,983	192,140	383,071	3,278	46,984	88,256	177,835
TOTAL	40,976	$532,381	826,825	$862,015	41,967	$483,355	340,158	$445,918

GRINDING AND POLISHING

(*Continued from page 685*)

with a silicon carbide wheel; patterns which guide the machine are made either of steel or nylon.

One final step: after the lenses are finished, any light scratch, no matter how infinitesimal, is removed by a special machine (made by Robinson Houtchin) which is essentially a motor with a sponge rubber buffer, ¼ in. in diameter, at the end of the shaft. All imperfections are removed with a compound—one-half cerium oxide and one-half water—without, of course, any change in the lens power.

One final check is made on the vertometer (Fig. 8) for axis, sphere, cylinder and prism.

Greatest Improvement

Aside from automatic machinery, according to Dan O'Brien, McLeod's shop superintendent, the greatest advances have been made in abrasives and polishing compounds. Prior to World War II almost all work was done by hand, with red rouge as a polishing material. This polished slowly and was extremely dirty to use because it impregnated not only the worker's skin but also the work. White rouge was later substituted; this was clean but proved even slower than the red. The need by the military during the war for fast, precision optical polishing led to the introduction of cerium oxide, which was both fast and clean. Since that time, there has been a steady rise in the quality and uniformity of polishing compounds.

Particular advantages of cerium oxide, according to O'Brien, are that (*1*) it lasts longer, while rouge breaks down and has to be replaced often, (*2*) lenses have less chromatic aberration after polishing with cerium oxide, (*3*) it is more easily cleaned off unpolished edges, (*4*) can be recirculated, and (*5*) disperses freely on polishing pads, in contrast to the caking of rouge. A large part of McLeod's success, he says, depends on the newer and more effective grinding and polishing compounds, and shop records show that the firm's reject rate from customers is less than ½ of 1 per cent.

GLASS DIVISION MEETING

(*Continued from page 692*)

specimen preparations, but also active work on crystal growth and methods of studying dislocations and other crystal defects. Plans for the near future will add work on preparing ceramic specimens with control over the microstructure, and preparative inorganic chemistry aimed at producing materials of ultrapurity. Crystal structure determinations form the second major topic. Chemistry in the solid state, including phase equilibria, phase transitions, vaporization at high temperatures, and effects of pressure on various physical properties, is the third topic. The fourth is physical properties of crystalline solids, with some emphasis on those properties related to defects in the crystal lattice. Surface properties, with emphasis on the preparation and characterization of clean, reproducible surfaces, are included in the plans, but work in this area is not yet active. Problems in the realm of the vitreous state in general, and silicate and related glasses in particular, are set aside in a special category. Work on the engineering properties, and specifically on polycrystalline ceramics, is now, and will continue to be, an important part of the program. Finally, special efforts in data compilation, information exchange, and standard sample preparation, but not falling into any given category above, are being considered.

The vitreous state group, under Dr. Bestul, is concerned with understanding the nature of the vitreous state in general, without necessary reference to any given materials. Their work at present involves studies of the molecular structure of substances in the vitreous state. They use rates of vaporization and residual entropy on inorganic and organic glasses, as well as the kinetics of crystallization of glass formers near the glass transformation temperature in order to understand how factors contributing to crystallization, or inhibiting it, relate to glass formation. They are carrying on studies of the glass transformation process itself, in glasses such as those formed by alcohol-water mixtures. In addition, very fundamental theoretical work on nonequilibrium flow processes is underway.

(To be concluded next month.)

EPOXY-GLASS LAMINATIONS

(*Continued from page 698*)

Modifying Automobile Bodies

A use that is of considerable value is in the modification of automobile bodies. If special contours are necessary, a clay model can be made to specification, suitably prepared with a soluble parting agent of polyvinyl alcohol and wax. A glass-epoxy laminate can be laid up over this clay model to form a mold. After curing and removal of the clay, a second laminate is laid up in this mold, duplicating exactly the outer dimensions of the clay model. This piece can be fixed in place either mechanically or with an epoxy adhesive and, after sanding and painting, it will become an indistinguishable and almost indestructible part of the car. If additional pieces are necessary, the original mold can be used over and over again.

Other Uses

Other uses include keller models, exhaust ducting, hoods, pressure vessels, instrument cases, filament-wound centrifugally cast pipe, hydroform dies, and even life-size statues—by coloring the resin to look like marble. It would be difficult to know, and to list, all current, approved uses, but it is significant that those mentioned here reach into many industries. The marriage of glass and epoxies is a beneficial one that is destined for a long, prosperous life.

HARTFORD-EMPIRE
EQUIPMENT AND
ENGINEERING
SERVICES
FOR THE
GLASS INDUSTRY

Batch Chargers
Glass Level Controls
Gob Feeders
Refractories
"28" Paste Mold Machines
I. S. (individual section) Forming Machines
Lehrs — Annealing, Decorating
Lehr Stackers
Automatic Inspection Equipment
Testing Equipment
Conveyors
Unit Melters
Furnace Designs
Plant Layout
Installation Service
Operating Service
Testing Laboratories
Consulting

From Concept through Construction and Start-Up to Full Production Hartford Can Help

Emhart Manufacturing Co.
Hartford Division
Hartford 1, Connecticut
EMHART
Cable Address: EMHART Phone: CHapel 9-0671 TWX: HF 286

INVENTIONS AND INVENTORS

(*Continued from page* 706)

Sheet and Plate Glass

Method and Apparatus for Cleaning and Bending Glass Sheets. Patent No. 2,985,986. Filed August 29, 1957. Issued May 30, 1961. Three sheets of drawings; none reproduced. Assigned to Libbey-Owens-Ford Glass Co. by Herbert A. Leflet, Jr.

It has been found that the most efficient manner of manufacturing a bent glass laminate, for example, a windshield, is to bend both sheets of a given laminate at the same time so that the curvature of each of the sheets will be substantially identical. At the same time, however, the presence of foreign matter between the sheets has always been a problem; a certain percentage of bent sheets have had to be rejected because of pitting which is caused by foreign matter trapped between the sheets during bending. In the production of severely bent sheets, the pitting problem becomes even more important since, in order to make relatively sharp bends in portions of the sheets, it is necessary that those portions be heated to a relatively high temperature; thus they become more softened and more susceptible to marring by foreign material located between the sheets.

The present invention involves a novel method and apparatus for cleaning and bending glass sheets in pair. A pair of glass sheets are heated with sufficient heat being directed toward the surface of one of the sheets in a relatively short time interval to cause a temperature differential between the opposite sheet surfaces. This causes the hotter surface to expand for a greater distance and more rapidly than the other, thus causing the sheet to bow in the direction of the hottest surface and creating a gap between the sheets through which a stream of gas, preferably air, is directed, contacting the adjacent facing surface of each of the sheets to sweep them clear of foreign material.

There were 17 claims and the following references.

United States Patents

2,377,849, Binkert, June 12, 1945; 2,486,153, Gwyn, October 25, 1949; 2,697,676, Black *et al.*, December 21, 1954; 2,713,011, Durst, July 12, 1955, and 2,725,320, Atkeson *et al.*, November 29, 1955.

Front Roll Drive for Window Glass Drawing Apparatus. Patent No. 2,974,447. Filed April 24, 1958. Issued March 14, 1961. Five sheets of drawings; none reproduced. Assigned to Pittsburgh Plate Glass Co. by Fred C. Tasher.

This invention relates to sheet glass drawing machines, such as those employed in the Pennvernon and Fourcault processes involving the use of a series of rolls in a vertical casing which grip the glass sheet between the members of each pair and provide the traction necessary for drawing the glass continuously from a bath of molten glass in a forehearth. The rolls on one side of the sheet are ordinarily mounted in fixed bearings, while the rolls on the other side are carried in movable bearings pressed in-

wardly by weighted levers; the latter, usually known as swing rolls, provide yielding pressure between the members of each pair of rolls. The manner in mounting the rolls, that is, one fixed and one movable, allows the passages of extreme differences in thickness of glass, such as caused when the drawing process is started or by improper operation in the drawing of the glass. Thus, the glass may be drawn and removed without breakage and the resultant problem involved in removing the broken glass from the glass machine is avoided.

There were three claims and the following references.

United States Patents

671,175, Appert, April 2, 1901; 1,818,207, Drake, August 11, 1931; 1,838,305, Genenger, December 29, 1931; 1,838,337, Von Reis, December 29, 1931; 2,141,101, Webster, December 20, 1938; 2,215,231, Redshaw, September 17, 1940; 2,311,075, O'Malley, February 16, 1943.

Miscellaneous

Process for the Protection of Glass Against Iridescence and Package for Carrying this Process into Effect. Patent No. 2,973,089. Filed May 8, 1957 (claims priority, application in Belgium, May 11, 1956). Issued February 28, 1961. One sheet of drawings; not reproduced. Assigned to Union des Verreries Mecaniques Belges, Societe Anonyme by E. Brichard, E. Plumat, and L. Leger.

The process consists essentially of arranging the glass so that it is kept in contact with sodium bisulphate. The presence of this agent inhibits or sufficiently retards the development of surface reactions which cause the phenomenon or iridescence so that in practice it is sufficient to remove this phenomenon under the usual conditions of storage and transport.

There were ten claims and the following references.

United States Patents

2,495,043, Willey *et al.*, January 17, 1950, and 2,528,391, Seddon, October 31, 1950.

Foreign Patents

394,635, Great Britain, June 29, 1933, and 1,937, Great Britain, 1864.

Glass Wool and Fiber

Method of, and Apparatus for, Producing Fibers and Thin Material. Patent No. 2,984,864. Filed February 12, 1959 (claims priority, application France, February 15, 1958). Issued May 23, 1961. Two sheets of drawings; none reproduced. Assigned to Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey, by Marcel Levecque and Marcel Mabru.

The invention contemplates the delivery of a supply stream of viscous material to the interior of a distributor or receptacle having a peripheral wall containing a plurality of orifices, preferably arranged in superposed rows. Upon rotation at high speed, for example 2600 to 3000 rpm, the distributor will project the collected viscous material over a surface, or plurality of surfaces, on one

A Key Chemical for the glass industry since 1890
Wyandotte Soda Ash
Soda Ash was our first product. The glass industry our first customer. Result: Over 70 years of experience producing soda ash, transporting it, studying its application in glass. Certainly a good background for a Key Chemical . . . may we work with you? Write us.
WYANDOTTE CHEMICALS
MICHIGAN ALKALI DIVISION, WYANDOTTE, MICHIGAN
Founded by a Glassmaker to Serve the Glass Industry
Circle No. 22

ELECTROCLEANING, INC.

Safeguarding Glass Mold Tolerances

•

Serving the Glass Container Industry

Installations at:

THATCHER GLASS MFG. CO. Elmira, New York	ALEXANDER H. KERR & CO. INC. Santa Ana, California
BROCKWAY GLASS CO., INC. Freehold, New Jersey	BROCKWAY GLASS CO., INC. Rosemount, Minnesota

ELECTROCLEANING, INC.
2709 EAST 93RD ST., CLEVELAND 4, OHIO
PHONE: 791-6930
Circle No. 23

GANAGLAS OSCILLATING

BATCH CHARGER

The ONE Charger that performs the work of TWO

From 5 tons daily extraction to 120 tons daily extraction
This method of charging has distinct advantages since
IT CHARGES THE BATCH IN A FAN-LIKE PATTERN, SPREADING A BLANKET OF BATCH ACROSS THE WIDTH OF THE TANK FURNACE and will incorporate the following favorable effects

◆ Efficient and rapid melting ◆
◆ Improved glass quality ◆
◆ Reduction of temperature fluctuations ◆
◆ The clogging of regenerators minimized and, ◆ in general,
◆ Refractory life is considerably prolonged ◆ Economical to operate
◆ Easily installed in conventional type dog-houses, ◆ without the necessity of purchasing a large number of "special shapes"

We welcome the opportunity of submitting full details

GENERAL GLASS EQUIPMENT CO., INC. INTERNATIONAL, INC.
ATLANTIC CITY, NEW JERSEY

Circle No. 24

or more plates turning about the same axis and surrounding the distributor. The projected material is guided and supported on these plate surfaces in such a manner as to assure its separation in a substantially homogeneous manner over the whole periphery of the surfaces. Each of the surfaces projects simultaneously from the whole of its periphery all the material which has been separated in the form of fibers uniformly surrounding the axis of rotation.

There were 30 claims and the following references.

United States Patents

2,194,727, Vello, March 26, 1940; 2,431,205, Slayter, November 18, 1947; 2,609,566, Slayter *et al.*, September 9, 1952; 2,612,654, O'Connor, October 7, 1952, and 2,863,493, Snow *et al.*, December 9, 1958.

Foreign Patents

205,437, Australia, December 27, 1956 and 1,124,487. France, July 2, 1956.

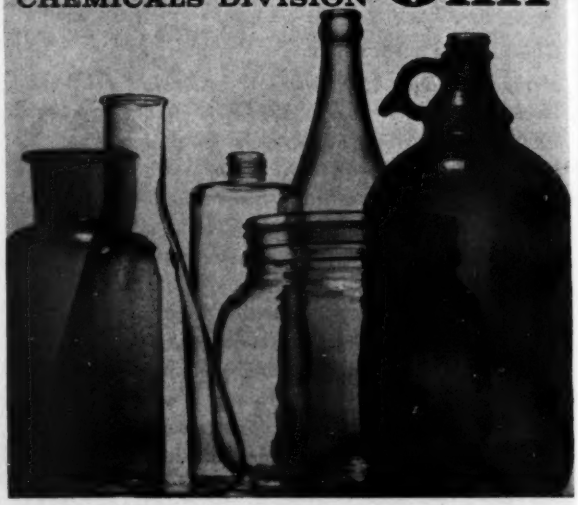
Metal Coated Glass Fibers and Method of Making Them. Patent No. 2,979,424. Filed September 17, 1953. Issued April 11, 1961. No drawings. Assigned to Owens-Corning Fiberglas Corp. by Harry B. Whitehurst, Albert R. Morrison, and Theodore J. Collier.

This invention relates to the manufacture of glass fibers having a metallic coating formed on the surfaces to improve the characteristics, appearance, and properties of the fibers, and to broaden their use. It is preferable to

Mathieson Soda Ash

For expert handling of your soda ash, Olin Mathieson has the experience and technical know-how to give you top-quality soda ash when, where and how you want it. Deliveries are made by rail, truck, or barge from our stocks at Saltville, Va., Lake Charles, La. or Wyandotte, Michigan. A detailed study of your handling problems will be made on request. Send for our free Soda Ash book. Write: OLIN MATHIESON, Baltimore 3, Md. 2/5

CHEMICALS DIVISION Olin



Circle No. 25

coat the glass fibers with a solution of salt, eliminating the diluent and leaving the salt uniformly distributed as a thin coating over the glass fiber surfaces. This enables reaction without interference by the carrier, and without the problems that might arise when it is necessary to first eliminate the carrier before metal formation by the desired reduction reaction. The salts may be applied to glass fiber surfaces without any previous coatings or sizes, or from which any size compositions have been removed by rinsing or burning off. The salt compositions may also be applied to glass fibers with surfaces roughened by an etching process or by a process in which the glass fibers have been leached to remove all but the silica, as previously described.

The number of salts which can be used for metal formation by thermal decomposition on glass fiber surfaces are very limited. It has been found that copper formate, silver formate, gold formate, and the noble metal chlorides such as the chlorides of palladium, platinum, gold and silver, break down in a peculiar manner to form the metal directly, instead of forming the oxide upon decomposition on the glass fiber surfaces. In addition, other compounds, such as tetraethyl lead and zinc triphenyl methyl, also break down to form corresponding metal upon decomposition at fairly low temperatures. The invention may be illustrated as follows.

Copper formate in amounts ranging from 10 to 30 per cent by weight was compounded into molten wax and formed into an applicator stick. Glass fibers in forming, or separate and apart from, were drawn over the stick and became coated with a thin film of the wax-copper formate composition. Upon heating the coated fibers to a temperature slightly in excess of 450°F, the formate was eliminated, leaving the copper in metallic form as a coating on the glass fiber surfaces. Although the coating was only a few molecules thick, additional thicknesses could be produced by application of a heavier wax coat or by repeating the coating and heating cycle. However, once the copper film was formed on the glass, additional thicknesses could also be achieved, if desired, by electroplating.

There were 7 claims and 22 references.

CLASSIFIED ADVERTISEMENT

Help Wanted

PHYSICAL CHEMIST/ CERAMIC ENGINEER

Position in research available for man with M.S. degree or equivalent whose interest and experience lie in the field of surface chemistry, decorative ceramic or precious metal coatings on glass. A background in glass helpful but not necessary. Work in modern laboratory in rural location near Chicago. Send complete resume and salary requirements to:

R. P. Eichhorn
CONTINENTAL CAN COMPANY
Hazel-Atlas Glass Division
Research & Development Dept.
Plainfield, Illinois

EISLER Equipment
solves glass problems!

Since 1920, designers and builders of special machinery and equipment for the glass industry . . .
Glass Lathes • Glass Cutters • Wet or Dry Silent Blast Torches • Cross Fires • Ribbon Fires • Gas and Oxygen Burners • Indexing Turntables • Sealing, Ampule and Bulb Blowing Machines, etc.
Call us now without obligation

Above: SPECIAL CROSSFIRES
Below: BLAST BURNERS

EISLER ENGINEERING CO., INC.
742 So. 13TH ST., NEWARK 3, N. J.
Charles Eisler, Jr.
President
Circle No. 26

Delos M. Palmer & Associates

Consulting Engineers
Mechanical, Electrical & Industrial
Designers of
Special Purpose Machinery
For The Glass Industry
Automation . . . Electronics

4401 JACKMAN ROAD TOLEDO 12, OHIO
Telephone: Greenwood 9-4453
Circle No. 27

PEN ELECTRO
Service to the Glass Industry

- Electric Booster Melting
- Molybdenum Electrodes
- Tubing Diameter Gagers
- Glass Bath Pyrometers
- All Electric Furnaces
- Electric Forehearths
- Bubbler Systems
- Color Feeders

Write for descriptive literature
PENBERTHY ELECTROMELT CO.
4301 6th AVE. SOUTH
SEATTLE 8, WASHINGTON

THE SHARP-SCHURTZ COMPANY

CHEMISTS AND CONSULTING ENGINEERS
FOR THE GLASS INDUSTRY

LANCASTER, OHIO U. S. A.

Circle No. 28

Thimbles Last 9 Times Longer with Colmonoy Inserts

Cast iron plunger guide rings (thimbles) can be made to last at least nine times longer by protecting them with inserts of cast Colmonoy No. 4. Colmonoy thimble inserts are available in fifteen stock sizes, and in special sizes to order. They are quality castings and are X-ray inspected. Easily machined with carbide tools, they are press-fitted or silver soldered in place. Besides providing long trouble-free operation, they produce more parts to correct size. Ask for Colmonoy Engineering Data Sheet No. 42A.

Colmonoy hard-surfacing alloys are saving the costs of replacing thimbles, neck rings, plungers, blowheads, moulds, and many other glass machinery parts, by making existing parts last much longer than ever before. Find out what Colmonoy alloys can do for your equipment. Write for more information today.

The plunger shown, mate to the Colmonoy-protected thimble, has been hard-surfaced with Colmonoy No. 4 also. The Colmonoy Spraywelder, a powder metal spraying unit, was used to produce the sprayed-and-fused overlay. The two parts, with similar long wearing surfaces, provide the ultimate in wear resistance.

HARD-SURFACING & BRAZING ALLOYS

WALL COLMONOY CORPORATION
19345 JOHN R STREET • DETROIT 3, MICHIGAN

Buffalo • Chicago • Houston • Los Angeles • Morrisville • New York • Pittsburgh • Montreal • London, England

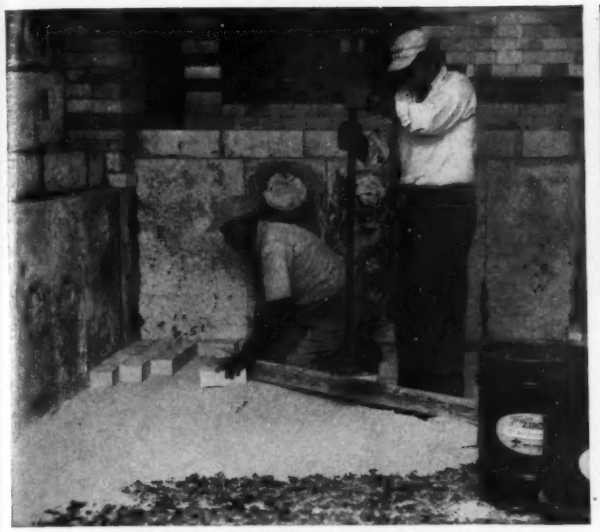
Circle No. 29

INDEX TO ADVERTISERS

	Page
Allied Chemical Corporation Solvay Process Division	690, 691
American Potash and Chemical Corporation	671
Babcock and Wilcox Company, The Refractories Division	676
Classified	715
Corhart Refractories Company	669
Diamond Alkali Company	699
Drakenfeld and Company, Inc., B. F.	673
Eisler Engineering Company, Inc.	715
Electrocleaning, Inc.	714
Emhart Manufacturing Company Hartford Division	712
FMC Corporation Chlor-Alkali Division	680
Frazier-Simplex, Inc.	667
General Glass Equipment Company, Inc.	714
Harbison-Carborundum Corporation	Cover IV
Harshaw Chemical Company, The	Cover II
Hommel Company, The O.	677
Kahle Engineering Company	670
Minneapolis-Honeywell Regulator Company	678, 679
Morgan Construction Company	696
Olin Mathieson Chemical Corporation	714
Overmyer Mould Company, Inc.	675
Palmer, Delos M.	715
Penberthy Electromelt Company	715
Pittsburgh Plate Glass Company Chemical Division	674
Selas Corporation of America	701
Sharp-Schurtz Company	715
Taylor Sons Company, Chas., The	Cover III
Toledo Engineering Company, Inc.	709
Wall Colmonoy Corporation	716
West End Chemical Company	672
Wyandotte Chemicals Corporation	713

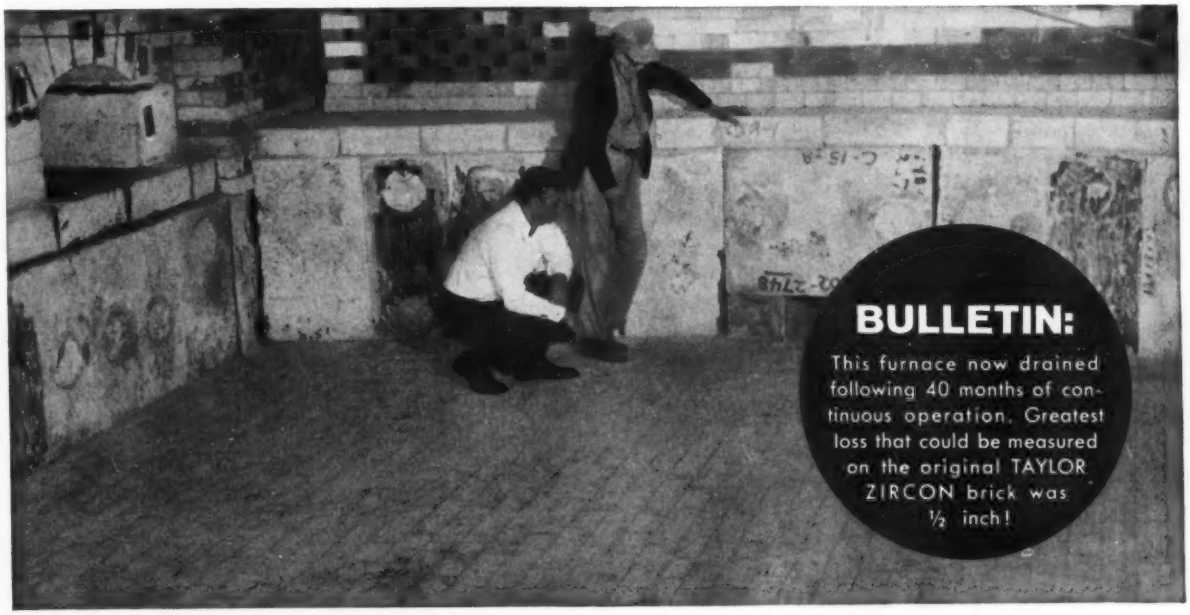
PAVE AND SAVE WITH

TAYLOR ZIRCON



Old clay bottom being leveled with TAYLOR ZIRCON ramming mix.

TAYLOR ZIRCON brick being laid over ramming mix.


BULLETIN:
This furnace now drained following 40 months of continuous operation. Greatest loss that could be measured on the original TAYLOR ZIRCON brick was ½ inch!

Inspection of tight joints and uniform paving of completed melter at throat end.

TAYLOR ZIRCON PAVING over old clay bottoms has been highly successful in opal tanks and flint container and tableware furnaces. Have you investigated this way to "Pave and Save with Taylor Zircon"? Write direct, or call in a Taylor field engineer for full details.

Exclusive Agents in Canada:
REFRACTORIES ENGINEERING and SUPPLIES, LTD.
Oakville, Ont., and Montreal

REFRACTORIES

The CHAS. TAYLOR SONS Co.

A Subsidiary of National Lead Company

REFRACTORIES SINCE 1864 — CINCINNATI, OHIO, U. S. A.

Reader Service Card: Circle No. 2

Technical Answers from

HARBISON CARBORUNDUM CORPORATION
Fused Cast Refractories

Isn't heat shock rough on *all* fused cast refractories?

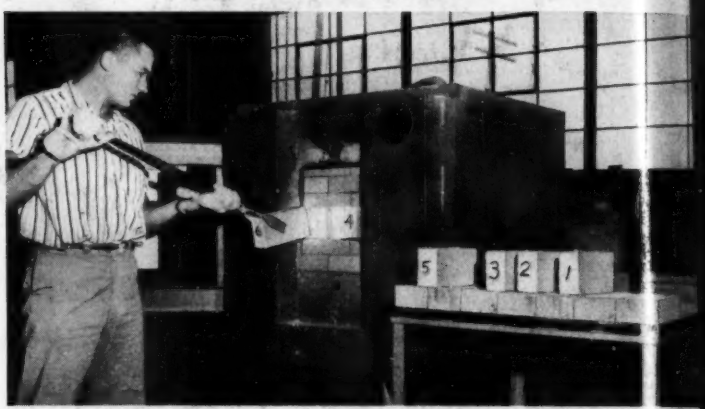
Not necessarily. MONOFRAX® Type H beta alumina superstructure refractory has extraordinary thermal shock resistance — surpassing that of many bonded refractories. Behavior somewhat more typical of fused cast refractories is exhibited by MONOFRAX Type S zirconia-alumina and MONOFRAX Type M alpha-beta alumina, but the lower thermal shock resistance of these chemical and crystalline types is offset by other factors more important in their recommended areas of application.

Knowledge of these variations in thermal shock resistance can be used to advantage in choosing refractories for both superstructure and glass contact services. MONOFRAX H, for instance, is unexcelled for port neck walls and caps, regenerator port assemblies, exhaust outlets and other areas where maximum temperature changes of regenerative firing are encountered. Type S works best in first and second port floors and jambs where a more rugged material must resist both molten batch carry-over and thermal shock. Type M supplies the best answer for a non-dripping, rugged, "dry" refractory in shadow walls and bridge covers, where there is little temperature change.

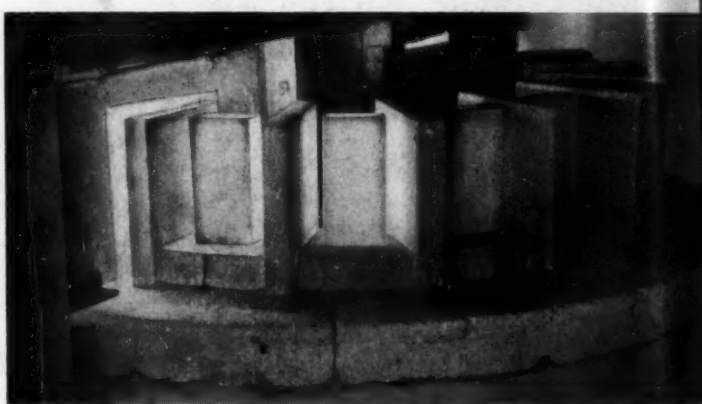
In glass contact work, Type S should be used in the doghouse assembly, melter sidewalls, electrode blocks and patch blocks where maximum corrosion and thermal shock resistance are needed. In the refining end, where there is no appreciable temperature change, Type M's absence of glass phase and upward drilling resistance dictate its usage.

With the range of types offered in MONOFRAX fused cast refractories, it is possible to select a combination of materials that will improve glass quality and increase life for a truly "balanced" tank. Our engineers will gladly help. Simply contact Department L-121, Harbison-Carborundum Corporation, Falconer, N. Y.

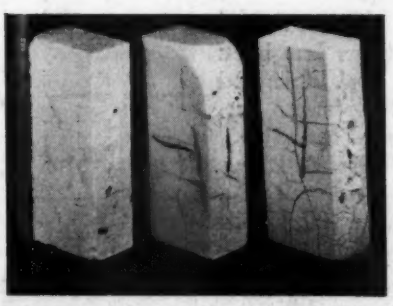
Laboratory tests such as those pictured here provide Harbison-Carborundum with a thorough understanding of the effect of thermal shock on the life and performance of different types of fused cast refractories.



In this modified panel spalling test, the hot end of the brick is subjected to rapid temperature changes closely simulating conditions in regenerative firing. Type H specimens showed no cracks after 57 half-hour cycles from 2200° F to ambient.



In this cycle test, the specimens rotate on a rotary hearth on 1-hour cycles from room temperature to furnace operating temperatures. The test is described in the July 1961 Bulletin of The American Ceramic Society. It offers an effective means of investigating the thermal shock resistance of refractories.



Comparative results with Monofrax types H, M and S after 75 1-hour cycles in the rotary hearth testing apparatus. Type H (left) is barely affected; Type S (right) shows surface cracking; Type M (center) shows corner spalls and deeper cracks, illustrating the variations in thermal shock resistance of different chemical and crystalline types of fused cast refractories.

Reader Service Card: Circle No. 1600 737